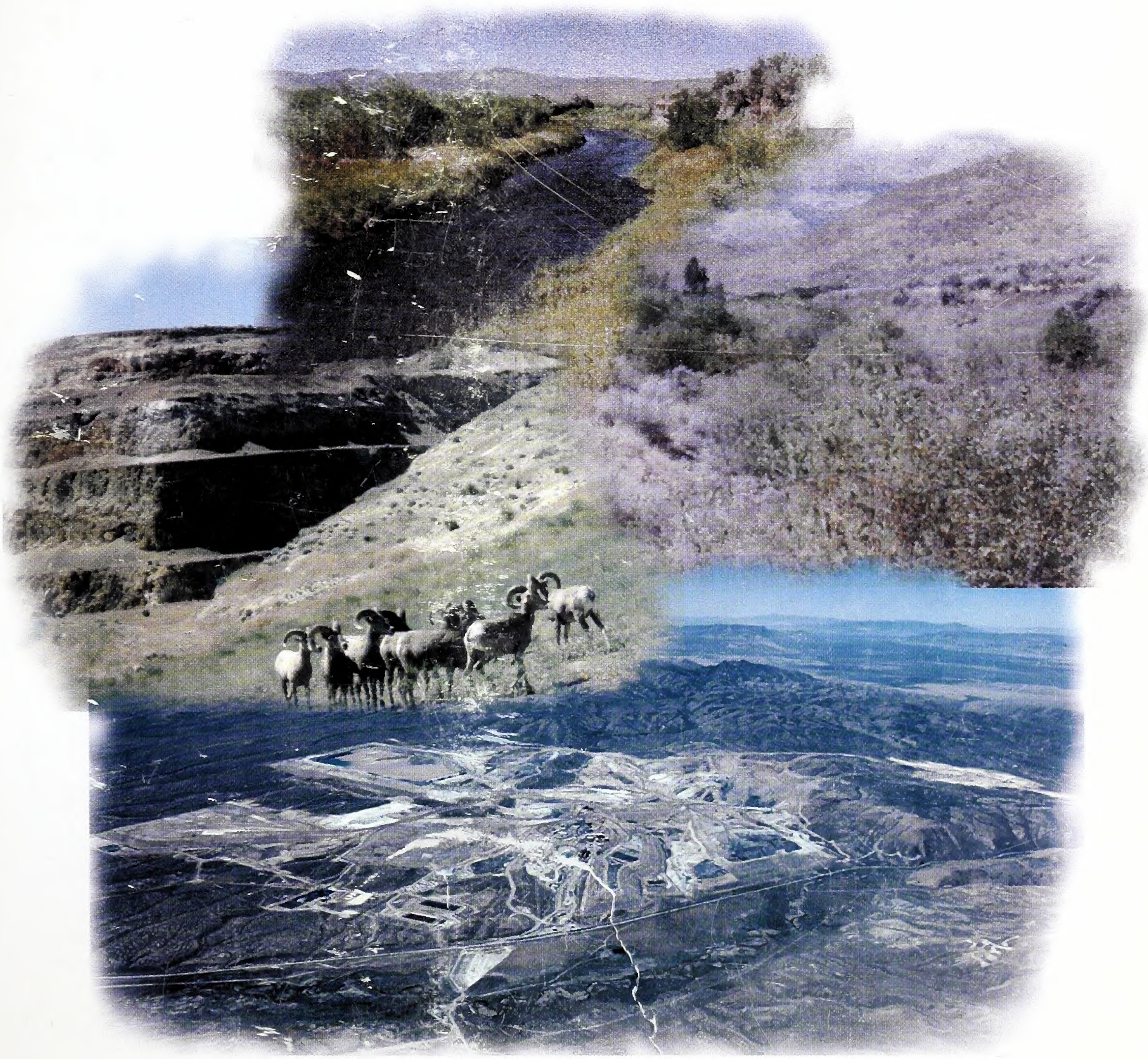
U.S. Department of the Interior
Bureau of Land Management
Elko Field Office
Elko, Nevada

September 2000

DRAFT Environmental Impact Statement Newmont Mining Corporation's South Operations Area Project Amendment



Mission Statement

The Bureau of Land Management is responsible for the stewardship of our public lands. It is committed to manage, protect, and improve these lands in a manner to serve the needs of the American people for all times. Management is based upon the principles of multiple use and sustained yield of our nation's resources within a framework of environmental responsibility and scientific technology. These resources include recreation, rangelands, timber, minerals, watershed, fish and wildlife, wilderness, air and scenic, scientific, and cultural values.

BLM/EL/PL-00/015+1793.4

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Elko Field Office
3900 East Idaho Street
Elko, Nevada 89801-4611
http://www.nv.blm.gov

In Reply Refer To:
1793.4/3809
N16-81-009P

August 21, 2000

Dear Reader:

Enclosed for your review and comment is the Draft Environmental Impact Statement (DEIS) for Newmont Gold Co.'s South Operations Area Project Amendment. The DEIS serves to analyze the effect of continuing mining and dewatering operations for ten years beyond the current permit. The South Operations Area Project consists of the Gold Quarry, Mac, and Tusc open pit gold mine, mill, and dewatering facilities, and is located approximately 6 miles northwest of Carlin, Nevada.

A separate report entitled Cumulative Impact Analysis of Dewatering and Water Management Operations for the Betze Project, South Operations Area Project Amendment, and Leeville Project analyzes the cumulative effects of dewatering from the three major dewatering projects on the Carlin Trend. This report is available from the Bureau of Land Management, Elko Field Office, or on the internet at www.nv.blm.gov/elko.

This DEIS addresses those concerns identified by the BLM or raised during public scoping from June 16 through July 18, 1997. The BLM, in conjunction with all interested parties, will propose mitigation measures to address incremental impacts which are over and above what was addressed in the 1993 South Operations Area Project EIS.

Following the 60 day public review and comment period, a Final EIS will be prepared. It will include mitigation measures that address both predicted direct impacts from Newmont's mining and dewatering operations, as well as for predicted cumulative impacts from the Newmont dewatering operations in relation to other active and proposed dewatering operations on the Carlin Trend. These other operations include the Barrick operations at the Betze/Post open pit mine and Newmont's proposed Leeville underground mine.

Public comments on the DEIS will be accepted during a 60-day comment period ending October 31, 2000. A public meeting to accept verbal and written comments is scheduled for September 26, 2000 at 5:00 P.M. at the BLM Elko Field Office. Comments on the DEIS should be submitted to: Bureau of Land Management, Elko Field Office, Attention: Roger Congdon, EIS Coordinator, 3900 Idaho St., Elko, NV 89801.

The Final EIS may be published in an abbreviated format so please retain this draft document for future reference. Your interest in the management of public lands is appreciated. If you have any questions, please contact Roger Congdon, EIS coordinator at (775)753-0200.

Sincerely,

Helen Hankins

Helen Hankins
Field Manager

DRAFT

ENVIRONMENTAL IMPACT STATEMENT
NEWMONT MINING CORPORATION
SOUTH OPERATIONS AREA PROJECT AMENDMENT

LEAD AGENCY

U.S. Department of the Interior
Bureau of Land Management
Elko Field Office
Elko, Nevada

PROJECT LOCATION

Elko and Eureka Counties, Nevada

COMMENTS ON THIS DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS) SHOULD BE DIRECTED TO:

Roger Congdon, Project Lead
Elko Field Office
Bureau of Land Management
3900 East Idaho Street
Elko, NV 89801

DATE DRAFT EIS WAS MADE AVAILABLE TO THE ENVIRONMENTAL PROTECTION AGENCY AND THE PUBLIC

September 1, 2000

DATE BY WHICH COMMENTS SHOULD BE RECEIVED BY THE BUREAU OF LAND MANAGEMENT

October 31, 2000

ABSTRACT

The Draft Environmental Impact Statement analyzes impacts associated with a proposal to continue and expand gold mining operations on the South Operations Area Project site in northeastern Nevada. Newmont has been mining at this location since 1981, and, in 1993 as a result of the South Operations Area Project EIS Record of Decision, has implemented an extensive Mitigation Plan which has proven effective in mitigating potential impacts and in some cases, improving environmental conditions. The annual progress report for the Mitigation Plan is provided as an appendix to this document. The Proposed Action includes: (1) additional mining to approximately 350 feet below the currently approved operating level of the Gold Quarry open pit mine, (2) continuing to dewater the mine and discharge groundwater (less than 30,000 gallons per minute) directly into Maggie Creek six miles above the confluence with the Humboldt River, (3) expand waste rock disposal facilities and leach facilities, and (4) construct associated ancillary facilities. Two alternatives to the Proposed Action are analyzed in the document. The Agency Preferred Alternative includes Alternative 1 - Proposed Action with Backfilling the Mac pit. A considerable portion of the Draft Environmental Impact Statement addresses and analyzes impacts associated with incremental dewatering issues and the resulting expanded cone of depression.

Responsible Official for DEIS: Helen Hankins

Manager, Elko Field Office

UNIT CONVERSION TABLE

From	To	Multiply By
Area		
acres	square feet	43,560
square miles	acres	640
Volume		
acre-feet	gallons	325,829
gallons	cubic feet	7.48
Flow		
cubic feet per second (cfs)	gallons per minute (gpm)	449
gpm	acre-feet per year	1.61
cfs	acre-feet per year	724
Concentration		
parts per million (ppm)	milligrams per liter (mg/L)	1
mg/L	micrograms per liter (μg/L)	1000
Loads		
tons per day (tpd)	tons per year (tpy)	365
tpy	pounds per day	5.48

Cover photographs, clockwise from top, left: Maggie Creek; Coyote Creek; oblique aerial view of Gold Quarry site; and Bighorn sheep on the Ivanhoe mine site. (Bighorn sheep do not occur at the Gold Quarry site.)

SUMMARY

Newmont Mining Corporation (Newmont) submitted a Plan of Operations describing proposed activities for the South Operations Area Project Amendment (SOAPA) in March 1997. The proposal would amend the existing Plan of Operations N16-81-009P. The Bureau of Land Management (BLM) reviewed the Amendment and determined that the Proposed Action had the potential to result in significant environmental impacts and that preparation of an Environmental Impact Statement (EIS) would be necessary.

Newmont proposes activities that would support continued operation and expansion of existing gold mining and processing at its South Operations Area Project in Eureka and Elko Counties, Nevada; six miles northwest of Carlin. The South Operations Area Project is located on both private lands owned or controlled by Newmont and on public lands administered by the BLM.

This EIS describes components of, reasonable alternatives to, and environmental consequences of implementing the SOAPA. Direct, indirect, and cumulative impacts on the affected environment have been analyzed for the Proposed Action and alternatives. The impacts described in this document will be the basis for a decision regarding the Proposed Action or alternatives and selection of appropriate mitigation. No distinction has been made between impacts occurring on public versus privately owned land that would result from the possible federal authorization. The SOAPA would not cause any new kinds of impacts (with certain exceptions) but would extend the time period during which existing impacts would continue.

Newmont began mining at the Gold Quarry Mine in 1981 under a Plan of Operations (as amended). In 1992, Newmont filed a Plan of Operations Amendment with the BLM Elko Resource Area Office proposing to expand mining at the site (Plan of Operations N16-81-009P). Newmont also changed the name of the operation to South Operations Area Project.

Existing operations at the Gold Quarry site were analyzed by the BLM in 1993 (BLM, 1993). Subsequently, the BLM issued a Record of Decision approving the project and requiring the implementation of an extensive mitigation plan developed by Newmont and the BLM (BLM, 1993). That mitigation plan contained numerous, specific actions to be taken to mitigate potential impacts to riparian and wetland areas, springs and seeps, streams and rivers, aquatic habitat and fisheries, threatened, endangered and candidate species, livestock grazing, terrestrial wildlife, soils, vegetation, visual resources, and recreation and wilderness. A major element of the mitigation plan was the Maggie Creek Watershed Restoration Project and its extensive requirements for monitoring, which are described in this document. Another major element of the mitigation plan was the reclamation and revegetation plan, which is described in Chapter 2.

The BLM recently prepared a Cumulative Impact Analysis report (BLM, 2000b) to

address potential cumulative dewatering and discharge impacts associated with Barrick's Betze Project and Newmont's proposed South Operations Area Project Amendment and Leeville Project. The results of this analysis are summarized in Chapter 5 of this EIS. The analysis may result in the implementation of mitigation measures to address the cumulative impacts of the groundwater pumping and water management operations of these three mines. The BLM will identify monitoring programs and mitigation measures in conjunction with the affected parties; monitoring and mitigation measures will be specified in the Final EISs for the three projects.

SUMMARY OF THE PROPOSED ACTION

The Proposed Action would provide for the expansion of mining at the Gold Quarry Mine. Total incremental disturbance in the South Operations Area associated with the Proposed Action would be 1,392 acres, of which 553 acres are private lands and 839 acres are public lands. The disturbed area would include the mine pit, leach pads, waste rock disposal facilities, haul roads, and ancillary mine facilities associated with the Proposed Action. These areas compare with the South Operations Area Project analysis of 2,047 acres of public land, 5,913 acres of private land, and a total surface disturbance of 7,960 acres.

Mining and processing operations would result in recovery of oxide and sulfide ores by deepening the existing Gold Quarry pit approximately 350 feet. Incremental disturbance area associated with development of the open pit would be 139 acres. Mining for the SOAPA would continue through the year 2011 and ore processing would continue through 2016.

Deepening of the Gold Quarry pit would result in further mining below the regional groundwater table and would require installation of additional dewatering wells to keep groundwater out of the mine pit. Dewatering would result in pumping and discharging water in excess of Newmont's water needs at the South Operations Area. Newmont proposes to pump water at rates of less than 30,000 gallons per minute (gpm), treat the water to State of Nevada standards, and discharge the water to Maggie Creek near the mine site. Dewatering activities would cease at the conclusion of open pit mining in the year 2011.

Waste rock generated during mining would be disposed at the existing Gold Quarry North Waste Rock Disposal Facility, the Gold Quarry South Waste Rock Disposal Facility and the James Creek Waste Rock Disposal Facility. Waste rock disposal at the South Waste Rock Disposal Facility would require an expansion of approximately 235 acres. Waste rock placed on the North Waste Rock Disposal Facility would disturb approximately 439 acres. The James Creek Waste Rock Disposal Facility would disturb approximately 255 acres. The total waste rock production for the amendment would be 408 million tons. These acreages represent an approximate 50 percent increase in the area of existing waste rock disposal facilities.

Combined ore production for the expanded pit is expected to be about 118 million tons. Of this amount, approximately 57 million tons

would be oxide and mill-grade sulfide ore. The remaining 61 million tons would be low-grade sulfide ore.

The proposed open pit expansion would require relocating 30 million tons of tailing from the James Creek tailing facility to the Mill 5/6 tailing facility. The tailing would be moved by dredging and surface mining techniques. This represents the removal of 186 surface acres of old tailing.

The existing oxide leach facilities in the South Operations Area would be expanded to accommodate the low grade oxide and biooxidized sulfidic refractory ore from the proposed Gold Quarry pit expansion. The South Area Leach facility expansion would consist of a southern extension of the existing Non-Property Leach Pad and construction of the Property Leach Pad 2. The leach pads would continue to be stacked in lifts to a maximum height of 300 feet. Process and stormwater ponds would be constructed down gradient of the proposed leach pads. The proposed leach pads would share the same process and stormwater ponds. All ponds would be fenced in compliance with Nevada Division of Wildlife (NDOW) specifications. Changes to leaching operations would involve the addition of approximately 487 acres, or about 40 percent more leaching area.

The Non-Property Leach Pad would be expanded along its existing southern edge and would disturb 182 acres of public lands. The expansion would buttress against the existing Non-Property Leach Pad and would ultimately contain approximately 245 million tons. The Property Leach Pad 2 would be operated independently from the existing Property Leach Pad. The proposed Property Leach Pad 2 including process and stormwater ponds would disturb 163 acres of public lands and would contain approximately 46 million tons.

Newmont proposes to construct an expansion to the Refractory Leach Facility to provide an ammonium thiosulfate leach pad for heap leaching the carbonaceous sulfidic refractory ore in lifts without removing it from the pad. This proposed Refractory Leach Facility expansion would disturb an additional 108 acres of public land and 219 acres of private land.

Tailing generated by the ore processing would continue to be disposed at the existing Mill 5/6 tailing facility. No additional acreage would be disturbed for expansion of the tailing storage facility.

Proposed reclamation activities at the South Operations Area would include neutralization of process solutions, regrading of disturbance areas, replacement of topsoil, and seeding, fertilizing, and mulching. The mine pit would not be reclaimed; however, the pit would be fenced or bermed.

PROJECT ALTERNATIVES

Alternatives identified in this EIS were developed in response to issues raised during public scoping and BLM review of the Proposed Action. Alternatives selected for detailed review in the EIS were based on one primary issue related to potential impacts resulting from the Proposed Action. This issue is feasibility of backfilling open mine pits to be consistent with Nevada Administrative Code (519A.250) concerning solid minerals reclamation standards and

policy statements outlined in the Federal Land Policy Management Act (PL 94-579, 43 USC 1701).

Two alternatives were developed to address this issue. In addition, the No Action Alternative was also carried through analysis. The alternatives are as follows.

Alternative 1 - Backfilling the Mac Pit

This alternative includes backfilling of the Mac open pit with waste rock generated from the Gold Quarry pit expansion. Backfilling the Mac pit would reduce the size of the waste rock disposal facilities by six acres. Total disturbance for this alternative would be 1,386 acres with 1,247 acres reclaimed.

Alternative 2 - Modified Waste Rock Disposal Facility Design

This alternative would modify the Gold Quarry South Waste Rock Disposal Facility by substituting some of the horizontal hauling distance for additional elevation in an attempt to have a smaller "footprint" for the facility (50 acres less). A smaller footprint would reduce the disturbance associated with a new diversion channel west of the disposal facility by three acres. Total disturbance for this alternative would be 1,339 acres with 1,200 acres reclaimed.

No Action Alternative

Expansion of the SOAPA mining facilities would not be approved. The Gold Quarry Mine would not expand beyond the currently approved Plan of Operations.

SUMMARY OF IMPACTS

Detailed analysis of potential impacts and mitigation measures are presented in Chapters 4 and 5, Consequences of the Proposed Action and Alternatives and Cumulative Effects Analysis, respectively. The following is a summary of potential impacts, by resource, resulting from implementation of the Proposed Action and alternatives. Impacts in this EIS address only the incremental effects of the proposed expansion and do not repeat the impacts analyzed in the original EIS (BLM, 1993).

PROPOSED ACTION

Geology and Minerals

Newmont's proposed amendment would move 526 million tons of waste rock and ore from the Gold Quarry pit to waste rock disposal facilities, leach processing facilities, and a tailing storage facility. Relocation of these rock materials would modify landscape and topography of the South Operations Area. Several million ounces of gold would be extracted from the geologic resource.

One sinkhole has been documented to-date in the area affected by dewatering at the Gold Quarry mine. A sinkhole was discovered in July 1996 along Maggie Creek that temporarily captured the Maggie Creek flow. Although development of the sinkhole is likely related to mine-induced drawdown, the mechanism for development of this sinkhole is not completely understood. Available

information on the geology in the region and prediction of groundwater drawdown were used to identify areas that potentially could be susceptible to sinkhole development. These areas include the large area underlain by carbonate rock located north of the Gold Quarry Pit. The development of sinkholes can pose a hazard to livestock, humans, and wildlife. If a sinkhole develops in an area containing buildings, roads, or other structures, damage to these structures may result.

Water Resources

The Proposed Action would require the expansion of pit dewatering operations. Approximately 459,000 acre-feet of groundwater would be removed through dewatering concurrent with mining activities. As a result, groundwater levels in the mine area would decline farther, causing incremental reduced flows or loss of springs, seeps, and streamflow in the project area. Based on the extent of groundwater drawdown predicted by a numeric model, approximately five spring and seep sites would be impacted. To date, none of the 25 springs predicted by these models for impact in the 1993 EIS have been affected. During the dewatering period, discharge of mine water would continue to increase flow in lower Maggie Creek and the Humboldt River. Reductions or possible elimination of baseflow would be expected to occur in portions of two streams due to the incrementally expanded cone of depression. These streams would also experience declines in, or elimination of baseflow after cessation of dewatering. To date, most of the eight streams predicted for dewatering impacts in 1993 have not been noticeably affected, but two locations in the narrows area of Maggie Creek may have experienced reduced flows during low flow seasons (BLM, 1993).

Flows in springs, seeps and streams would eventually return to pre-mining conditions after pumping has ceased and the groundwater cone of depression has recovered sufficiently. Recovery of the water table to near original levels may take over 100 years; however, results of the model indicate that 95 percent of groundwater recovery would occur within 60 years after dewatering ceases. Evaporation from the pit lake would prevent complete recovery of the water table. Three adjudicated surface water rights would potentially be affected by lost or reduced flows. To date, none of the seven water rights predicted for impact in 1993 have been affected.

The Gold Quarry pit would fill with groundwater to an ultimate saturated depth of about 855 feet. Most of the pit lake would form during the first 10 to 20 years after mining ceases. As a result of several factors, including carbonate rock in the pit walls, the ultimate pit lake chemistry is expected to be similar to that of existing groundwater.

Floodplains

The Proposed Action would have no additional effects on floodplains in the study area beyond those identified in the original EIS (BLM, 1993). That document indicated that Maggie Creek could have increased flows during mining which might increase the width of the floodplain. After mining, the baseflow in Maggie Creek might be reduced, which would serve to reduce the floodplain and make it more upland in nature. No detectable

effect would be expected on the Humboldt River floodplains.

Soils

Soils located on approximately 1,392 acres would be disturbed by the Proposed Action. Implementation of the proposed reclamation plan would result in soils being redistributed on approximately 1,253 acres which includes all proposed disturbance areas except the mine pit. Soil losses are expected to be minimal as a result of establishing vegetation cover on stockpiles to reduce wind and water erosion.

Vegetation

Mine expansion would disturb approximately 1,392 acres of vegetation. With the exception of the 139 acres of the mine pit, reclamation would restore vegetation cover on all proposed disturbance areas.

Noxious Weeds

The amendment would disturb 1,392 acres during construction that would provide invasion sites for noxious weeds. The expansion would remove 45 acres of scotch thistle and several hundred saltcedar plants from the area used for facility construction. Newmont's weed control program would be continued.

Riparian Areas and Wetlands

It was determined that no wetlands would be disturbed in the amendment area and a total of 0.89 acres of Waters of the U.S. would be disturbed in Section 18, T33N, R52E.

A limited amount of riparian vegetation may be affected by the proposed dewatering program. Potentially affected wetland/riparian areas are associated with the two streams discussed in the Water Resources section. In addition, a reduction or loss of flow in five spring and seep sites would cause an additional 2.5 acres of riparian/wetlands to be affected. No additional effects on riparian areas along the Humboldt River would occur, beyond those described in the original EIS (BLM, 1993).

Terrestrial Wildlife

Impacts on terrestrial wildlife would include loss of habitat and loss and displacement of wildlife from the affected habitat. Reductions or elimination of flows in springs, seeps, and streams due to dewatering would impact wildlife species dependent on these sites (e.g., amphibians and certain birds) and may affect distribution of other species (e.g., bats, mule deer, and pronghorn antelope) that use these sites as part of a larger habitat complex. Reclamation would restore habitat on 1,253 of the 1,392 acres disturbed.

Aquatic Habitat and Fisheries

Incremental reductions or elimination of base-flow associated with dewatering would decrease habitat quality for fish and other aquatic organisms in Fish and Maggie Creeks. These flow changes would occur primarily during low-flow periods for up to 60 years after dewatering. Intermittent streamflows would eliminate or restrict fish and many aquatic insects in dewatered portions of streams.

Threatened, Endangered, Candidate, and Sensitive Species

Lahontan cutthroat trout could be indirectly affected by the proposed amendment. Eight tributary streams were predicted to be impacted in 1993. Habitat in portions of Maggie Creek could be degraded by baseflow reductions resulting from mine dewatering (impacts on Maggie Creek are also predicted by existing operations and SOAPA would extend those impacts in time). Potential dewatering impacts to Maggie Creek could affect the California floater. Effects on other species of concern would be minimal.

Livestock Grazing

The Proposed Action would affect three grazing allotments and permittees. Five spring and seep sites and two streams within the study area would be affected by the incremental expansion of the cone of depression, reducing availability of stockwater. Stocking rates would likely be reduced on some grazing allotments throughout the period of drawdown and recovery of the cone of depression. A total of 71 animal unit months on public land could be suspended due to the expansion of the SOAPA perimeter fences.

Some areas, such as the mine pit, would be permanently lost to livestock grazing. Steep slopes on reclaimed waste rock disposal areas or leach pads may result in limited use by livestock. Permanent losses in grazing areas associated with the mining pit, coupled with uncertainty regarding stockwater availability, may result in permanent reductions in stocking rates on some allotments.

Recreation

The Proposed Action would result in 1,392 fewer acres being available for recreational use during and after mining. Visitation pressures on the current recreational facilities within Elko and Eureka Counties would continue but not be increased.

Visual Resources

The primary impact on visual resources from the Proposed Action would be additional modification of landforms. There would be little additional visual contrast in areas where existing facilities are visible.

Noise

There would not be any change in existing noise levels. Mining disturbance would continue for an additional 10 years.

Cultural Resources and Native American Religious Concerns

There would be no direct impacts on cultural resources. Based on information about potential dewatering of certain springs, there is potential for indirect impacts to Western Shoshone traditional values, practices, and properties.

Social and Economic Impacts

No temporary socioeconomic impacts from the proposed amendment would occur during the construction period within local communities.

Property taxes and net proceeds of mining taxes would continue to be paid to Eureka County, whereas most sales tax revenues would accrue in Elko County. Wages spent by miners and workers in mining related occupations would continue to contribute to local revenues through sales and use taxes.

Wastes - Solid or Hazardous

There would be no significant change in waste generation or handling under the Proposed Action.

Environmental Justice

No impacts on environmental justice would occur.

ALTERNATIVES

Where specific impacts, by resource, are not presented under each alternative, it is to be assumed that those impacts would be the same as that of the Proposed Action.

ALTERNATIVE 1

Geology and Minerals

The alternative would eliminate access to ore reserves remaining in the Mac pit. Waste rock disposal facilities would be approximately 6 acres smaller.

Air Resources

An increase in diesel and fugitive dust emissions would occur as a result of increased haul distance for waste rock disposal in the Mac pit.

Soils

The alternative would spread topsoil over an additional 40 acres of the backfilled Mac pit and disturb six fewer acres for waste rock disposal.

Vegetation

The alternative would revegetate an additional 40 acres of the backfilled Mac pit and disturb six fewer acres of vegetation.

Terrestrial Wildlife

An additional 40 acres would be available for wildlife habitat and use under this alternative.

ALTERNATIVE 2

Geology and Minerals

This alternative is similar to the Proposed Action but would result in the South Waste Rock Disposal Facility being smaller in area by 53 acres but taller than the Proposed Action by approximately 100 feet.

Soils

Soils would be disturbed on 53 fewer acres, but topsoil spreading would be the same as for the Proposed Action.

Vegetation

Approximately 53 fewer acres would be disturbed, but the revegetation area would be the same as the Proposed Action.

Visual Resources

The South Waste Rock Disposal Facility would be approximately 100 feet taller which would allow the facility to be more dominant on the landscape as seen from observation points. The difference in height would not have a significant effect on the viewshed.

NO ACTION ALTERNATIVE

Under this alternative, the proposed Plan of Operations Amendment would not be approved and further disturbance of public land would not occur. Mining would continue until 2001, dewatering and ore processing until 2006.

AGENCY PREFERRED ALTERNATIVE

As a result of the analysis in this EIS, the BLM has selected as the Preferred Alternative, the Proposed Action with Backfilling of the Mac pit.

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Cumulative Impact Analysis of Dewatering and Water Management Operations for the Betze Project, South Operations Area Project Amendment, and Leeville Project. Report available at Bureau of Land Management, Elko Field Office, 3900 E. Idaho St., Elko, Nevada, 89801. (775) 753-0200. E-mail address: <www.nv.blm.gov/elko>

CHAPTER 1
PURPOSE AND NEED

CHAPTER 1

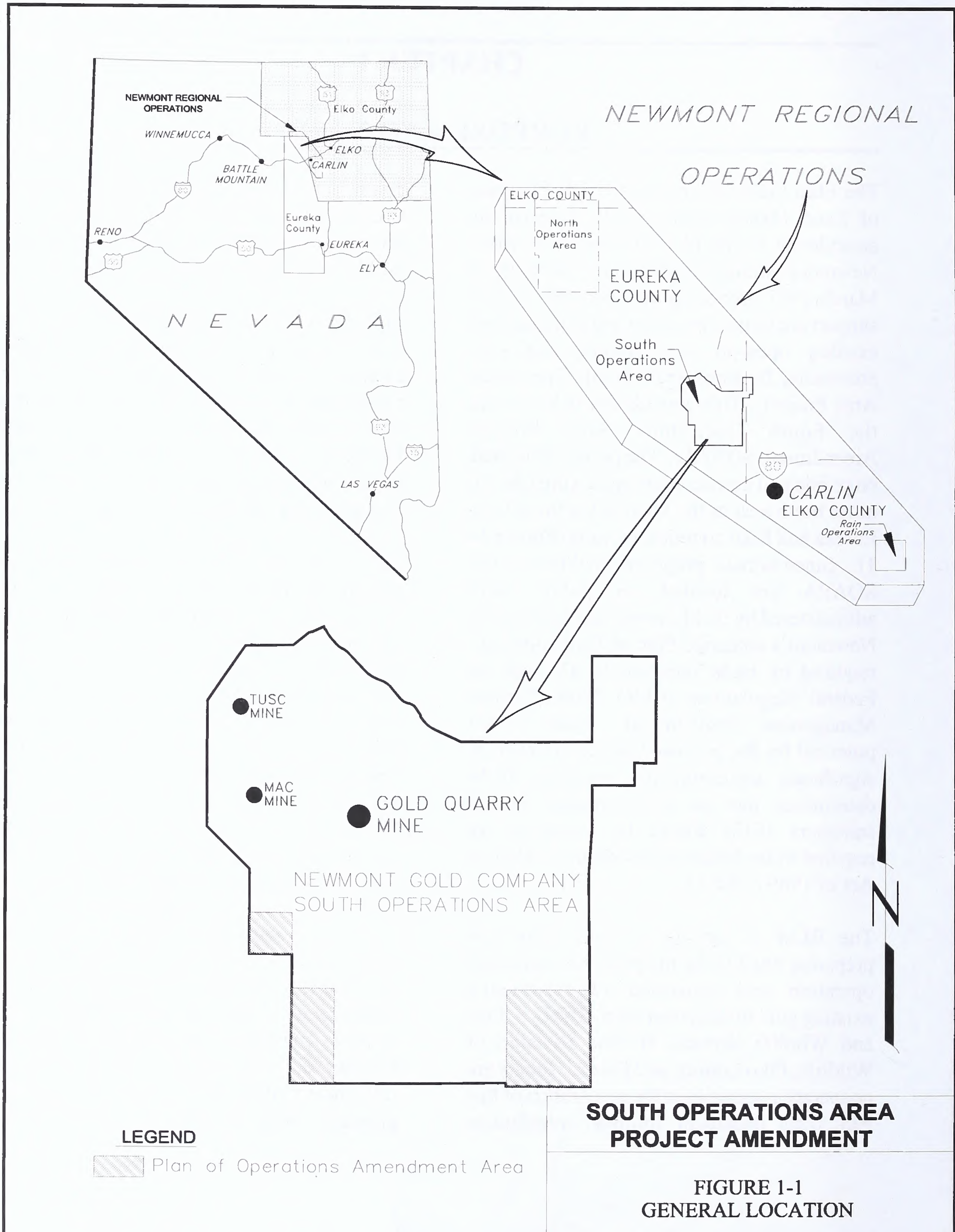
PURPOSE AND NEED

The Elko Field Office of the U.S.D.I Bureau of Land Management (BLM) received an amendment to the Plan of Operations from Newmont Mining Corporation (Newmont) in March 1997 proposing activities that would support continued operation and expansion of existing open-pit gold mining and ore-processing facilities at its South Operations Area Project. This amendment is known as the South Operations Area Project Amendment (SOAPA). The project is located on public and private lands approximately six miles northwest of the town of Carlin in both Eureka and Elko counties, Nevada (**Figure 1-1**). Since certain proposed facilities in the SOAPA are located on public land administered by BLM, review and approval of Newmont's amended Plan of Operations are required by BLM pursuant to 43 Code of Federal Regulations (CFR) 3809 (Surface Management Regulations). Due to the potential for the proposed project to result in significant environmental impacts, BLM determined that an environmental impact statement (EIS) would be necessary, as required by the National Environmental Policy Act of 1969 (NEPA).

The BLM is serving as lead agency in preparing this EIS for the proposed continued operation and expansion of Newmont's existing gold mining operation. The U.S. Fish and Wildlife Service, Nevada Division of Wildlife, Elko County, and Eureka County are cooperating agencies in the preparation of this EIS. This document follows regulations promulgated by the Council on Environmental Quality for implementing the procedural provisions of NEPA (40 CFR 1500-1508) and BLM's NEPA Handbook (H-1790-1).

In 1993, the BLM prepared an EIS and issued a Record of Decision approving expanded mining operations in Newmont's South Operations Area Project. In many cases, this EIS will refer the reader to the original South Operations Area Project EIS (BLM, 1993) rather than repeat information that has not changed substantially over the past six years.

This EIS describes the components of, reasonable alternatives to, and environmental consequences of continued operation and expansion of mining and processing facilities in the South Operations Area. Chapter 1 describes Purpose and Need, the role of BLM, and summarizes public participation in the EIS process. Chapter 2 provides a complete description of the existing operations and Proposed Action, and alternatives to the Proposed Action. Chapter 3 describes the existing environment in the SOAPA area. Direct, indirect, and cumulative impacts associated with the Proposed Action and alternatives, and possible mitigation measures to reduce or minimize impacts, are described in Chapters 4 and 5. Consultation and coordination with federal, state, and local agencies and a list of preparers is included in Chapter 6. Chapter 7 contains a list of references cited in developing the EIS, glossary, and a list of abbreviations.



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 1-1
GENERAL LOCATION

DATE: 6/5/00	ACAD FILE: Fig1-1.DWG
SCALE: NTS	DRAWN BY: MP, DESIGNED BY LW

PURPOSE AND NEED

Newmont's purpose in proposing the continued operation and expansion of its existing open-pit mining and ore-processing operations at the South Operations Area is to use its existing work force, mining and milling equipment, and ore-processing facilities to produce gold from the Gold Quarry Mine, which would be expanded laterally and at depth. Gold is an established commodity with international markets. Uses include investments, standard for monetary systems, jewelry, electronics and other industrial applications. The need for the project is to recover as much of the mineral deposit as is technically and economically possible, consistent with applicable federal, state, and local environmental, permitting, and operational requirements to meet this demand.

AUTHORIZING ACTIONS

A proposed mining Plan of Operations submitted to the BLM may be approved only after an environmental analysis is completed as required by NEPA. BLM decision options include approving Newmont's SOAPA as submitted, approving alternatives to the amendment to mitigate environmental impacts, or approving the SOAPA with stipulations to prevent unnecessary or undue degradation of environmental resources.

A substantial portion of Newmont's proposed new facilities would be located in whole or in part on unpatented mining claims administered by BLM. Such operations must comply with BLM regulations for mining on public lands (43 CFR 3809, Surface Management Regulations), the Mining and Mineral Policy Act of 1970, and the Federal Land Policy Management Act of 1976. These regulations recognize the statutory right of mining claim holders to develop federal mineral resources under the Mining Law of 1872. These statutes, however, in combination with other BLM regulations also require the BLM to analyze proposed mining operations to ensure that: (1) adequate provisions are included to prevent undue or unnecessary degradation of public lands, (2) measures are included to provide for reasonable reclamation of disturbed areas, and (3) proposed operations will comply with other applicable federal, state, and local laws and regulations.

In addition to BLM, other federal, state, and local agencies have jurisdiction over certain aspects of the Proposed Action. **Table 1-1** provides a comprehensive listing of the agencies and identifies their respective permit/authorizing responsibilities.

Eureka County adopted their Land Use Plan in 1998. The Land Use Plan establishes county policy regarding federal decisions which may affect local land use and community stability.

RELATIONSHIP TO BLM AND NON-BLM POLICIES, PLANS, AND PROGRAMS

The amendment to the Plan of Operations has been reviewed for compliance with BLM policies, plans, and programs. The proposal is in conformance with the Minerals Management Prescription in the Elko Resource Management Plan, approved in March 1987.

TABLE 1-1
REGULATORY RESPONSIBILITIES

Authorizing Action	Regulatory Agency
Plan of Operations and Amendments*	BLM
National Environmental Policy Act	BLM
National Historic Preservation Act	BLM and Nevada Division of Historic Preservation and Archaeology
Native American Graves Protection and Repatriation Act	BLM
American Indian Religious Freedom Act	BLM
Clean Water Act (Section 404)*	U.S. Army Corps of Engineers
Microwave Radio Station License	Federal Communications Commission
Radio Station License	Federal Communications Commission
High Explosive License/Permit	Bureau of Alcohol, Tobacco, and Firearms
Industrial Artificial Pond Permit*	Nevada Division of Wildlife
Water Appropriation Permit	Nevada Division of Water Resources
National Pollutant Discharge Elimination System Permit	Nevada Division of Environmental Protection, Department of Conservation and Natural Resources
Air Quality Operating Permit	Nevada Division of Environmental Protection, Bureau of Air Quality
Water Pollution Control Permit*	Nevada Division of Environmental Protection, Bureau of Mining Regulation and Reclamation
Mine Reclamation Permit*	Nevada Division of Environmental Protection, Bureau of Mining Regulation and Reclamation
Solid Waste Disposal Permit	Nevada Division of Environmental Protection, Bureau of Waste Management
Potable Water	Nevada Division of Health, Department of Human Resources
Tailing Impoundment - Construction Permit	Nevada State Engineer's Office - Dam Safety
Sewer System Approval	Nevada Division of Health; Nevada Division of Environmental Protection, Bureau of Waste Management
Radioactive Materials License (Laboratory)	Nevada Division of Health
Safety Plan	Mine Safety and Health Administration
Threatened and Endangered Species Act	U.S. Fish and Wildlife Service
Compliance with Land Use Plans	Eureka County

*Permit/Approval would be modified in response to the SOAPA.

This document uses "tiering" extensively to direct the reader to previously-published documents and analyses. This is done in accordance with NEPA regulations at 40 CFR 1502.20 and 1508.28. Tiering allows the EIS to summarize issues discussed in previous documents, incorporate those analyses by reference, and allows the lead agency to concentrate on the issues specific to the subsequent action. The subsequent document must state where the earlier documents are available. Tiering is appropriate when the sequence of analyses proceeds from an EIS to a subsequent statement or analysis at a later stage. This is the case with SOAPA. The original EIS was prepared in 1993 and many of the resource analyses in that document still apply. Tiering in such cases is appropriate when it helps the BLM focus on the issues that are crucial for present management decisions and to exclude from consideration issues already decided or not crucial for present management decisions.

ISSUES

To allow an early and open process for determining the scope of significant issues related to the Proposed Action (40 CFR 1510.7), a public scoping period was provided by BLM. A Notice of Intent to prepare the EIS was published in the Federal Register on June 19, 1997. Publication of this notice in the Federal Register initiated a 30-day public scoping period for the Proposed Action that provided for acceptance of written comments through July 18, 1997. Details of scoping are presented in Chapter 6.

Public comments concerning the scope of the EIS are grouped according to general subject area and summarized in **Table 1-2**. This table also provides references to the sections of this EIS which respond to each issue raised in the comments.

TABLE 1-2
ISSUES AND CONCERNS IDENTIFIED IN SCOPING

Issue	EIS Document Section(s)
Mine Dewatering	
Disruption of surface water and groundwater hydrology and impacts on water quality.	Chapter 3 - Water Resources Section Chapter 4 - Water Resources Section
Potential impacts of the cone of depression created by dewatering on fish and wildlife dependent on aquatic and riparian habitats.	Chapter 4 - Wetlands - Direct and Indirect Impacts Section Chapter 4 - Aquatic Habitat and Fisheries - Direct and Indirect Impacts Section
Potential effects of reduced flows in upper Maggie Creek on possible reintroduction of Lahontan cutthroat trout.	Chapter 4 - Threatened, Endangered, Candidate, and Sensitive Species - Direct and Indirect Impacts Section
Potential for the cone of depression from dewatering to impact the Carlin water supply.	Chapter 4 - Water Resources - Direct and Indirect Impacts Section
Mine Water Disposal	
Potential impacts of water discharge on channel stability of Maggie Creek and the Humboldt River.	Chapter 4 - Water Resources - Direct and Indirect Impacts Section
Potential impacts of changes in water quality and quantity on fish, wildlife, and stockwater.	Chapter 4 - Aquatic Habitat and Fisheries - Direct and Indirect Impacts Section Chapter 4 - Terrestrial Wildlife - Direct and Indirect Impacts Section Chapter 4 - Livestock Grazing - Direct and Indirect Impacts Section
Potential for increased flows in the Humboldt River to affect water rights or use by irrigators.	Chapter 4 - Water Resources Section
Potential for removal of groundwater from the basin to conflict with water rights and water management policy.	Chapter 3 - Water Resources Section Chapter 4 - Water Resources Section
Wildlife, Fisheries, and Aquatic Communities	
Potential impacts on avian breeding, nesting, cover, foraging habitat, and migration.	Chapter 4 - Wetlands - Direct and Indirect Impacts Section Chapter 4 - Terrestrial Wildlife - Direct and Indirect Impacts Section Chapter 4 - Threatened, Endangered, Candidate, and Sensitive Species - Direct and Indirect Impacts Section
Potential impacts on species of concern.	Chapter 4 - Threatened, Endangered, Candidate, and Sensitive Species - Direct and Indirect Impacts Section
Visual Quality	
Potential impacts to visual quality to viewers east of the project site.	Chapter 4 - Visual Resources Section
Land Use	
Restoration of pre-mining land uses following mining.	Chapter 2 - Reclamation Section
Potential impacts from new right-of-way extensions.	Chapter 4 - Land Use Section

TABLE 1-2 (continued)
ISSUES AND CONCERNS IDENTIFIED IN SCOPING

Issue	EIS Document Section(s)
Alternatives	
Partial or complete backfill of pits.	Chapter 2 - Alternatives Section
Cumulative Effects	
Potential cumulative impacts of dewatering activities of mines along the Carlin Trend.	Chapter 5 - Cumulative Effects - Water Resources; Riparian Areas and Wetlands Section
Potential cumulative impacts of past and anticipated mine expansions within the BLM Elko Area and Humboldt National Forest.	Chapter 5 - Cumulative Effects Section
Mitigation	
Measures to avoid, reduce, or compensate for direct and indirect habitat losses and other potential impacts on fish and wildlife.	Chapter 4 - Aquatic Habitat and Fisheries - Potential Mitigation and Monitoring Measures Section Chapter 4 - Terrestrial Wildlife - Potential Mitigation and Monitoring Measures Section
Monitoring	
Monitoring potential indirect impacts on the Humboldt River and tributaries.	Chapter 3 - Water Resources Section Chapter 4 - Water Resources - Potential Mitigation and Monitoring Measures Section Chapter 5 - Cumulative Effects Section
Reclamation	
Description in reclamation plan of final water quality in water-filled pit.	Chapter 2 - Proposed Action - Reclamation Section Chapter 4 - Water Resources - Direct and Indirect Impacts Section

CHAPTER 2
PROPOSED ACTION, INCLUDING ALTERNATIVES

CHAPTER 2

PROPOSED ACTION, INCLUDING ALTERNATIVES

This chapter provides a description of Newmont's existing operations in the South Operations Area, Newmont's Proposed Action to continue and expand operations in the South Operations Area, and reasonable alternatives to the Proposed Action. Alternatives considered are based on issues identified by the BLM and public comments received during the public scoping process and are intended to reduce or minimize potential impacts associated with the Proposed Action.

Newmont currently mines and processes gold bearing ore along a 38-mile segment of the Carlin Trend in northeastern Nevada. The proposed South Operations Area Project Amendment would allow the continued operation and deepening of the Gold Quarry pit and expansions to existing waste rock and leach facilities. The impacts have been assessed for the existing South Operations Area Project through year 2001, including the disturbance of 2,047 acres of public land and 5,913 acres of private land (BLM, 1993). The SOAPA would amend the existing Plan of Operations, N16-81-009P, continuing operations until the year 2011 and involving additional disturbance of 839 acres of public land and 553 acres of private land, and extend dewatering.

Development of the proposed facilities would occur on a combination of public and private lands. The majority of mining and ore processing facilities in the South Operations Area are located on private lands which Newmont owns or controls. The public lands are managed by the Elko Field Office of the BLM. In accordance with NEPA, the BLM has reviewed the SOAPA and determined that since the proposed project could potentially result in significant environmental impacts, an EIS would be necessary. Preparation of this document follows Council on Environmental Quality regulations under NEPA (Title 40 Code of Federal Regulations [CFR] Parts 1500-1508), BLM regulations at 43 CFR 3809, and the BLM NEPA Handbook (H-1790-1) pertaining to mineral operations conducted on public lands under the Mining Law of 1872, 30 USC 22 *et seq.*

Detailed discussions of the following topics are presented in Chapter 2:

- Newmont's existing operations in the South Operations Area.
- Newmont's Proposed amendment for the South Operations Area Project.
- Alternatives to the Proposed Action including the No Action Alternative and alternatives considered but dismissed from detailed analysis.

Activities in the South Operations Area have been expanded periodically since production began in 1985. In 1990, Newmont filed an amended Plan of Operations (N16-81-009P) with the BLM to secure authorization for construction of various mining and processing facilities, including: a combined waste rock and tailing storage facility, access roads, slurry and reclaim water pipelines, power

distribution systems, underdrainage reclaim ponds, downstream cutoff trenches, monitoring wells, and topsoil stockpile areas. In May 1991, BLM approved the amended Plan of Operations at the South Operations Area through December 30, 1994 (EA-NV-010-91-055).

In February 1992, Newmont filed an amended Plan of Operations with the BLM to expand the South Operations Area to include two satellite ore bodies, the Mac and Tusc deposits. Also proposed was a haul road from Newmont's North Operations Area to the South Operations Area. Other facilities proposed included waste rock disposal areas, heap leach pads, expansion of the existing tailing storage facilities, a mine dewatering system, and a water treatment and discharge system, refractory ore stockpiles, a sanitary landfill, exploration drilling, expansion of the Gold Quarry pit, construction of a roaster, and construction ofbioleach facilities. The project required mine dewatering because of the expansion of the Gold Quarry pit both laterally and deeper. New facilities also included the construction of a roaster to treat refractory ore. The proposed amendment was evaluated with an EIS. In response to the EIS, Newmont prepared a Mitigation Plan to eliminate or reduce the potential impacts identified. The proposed amendment with mitigating measures was approved November 18, 1993 (BLM, 1993).

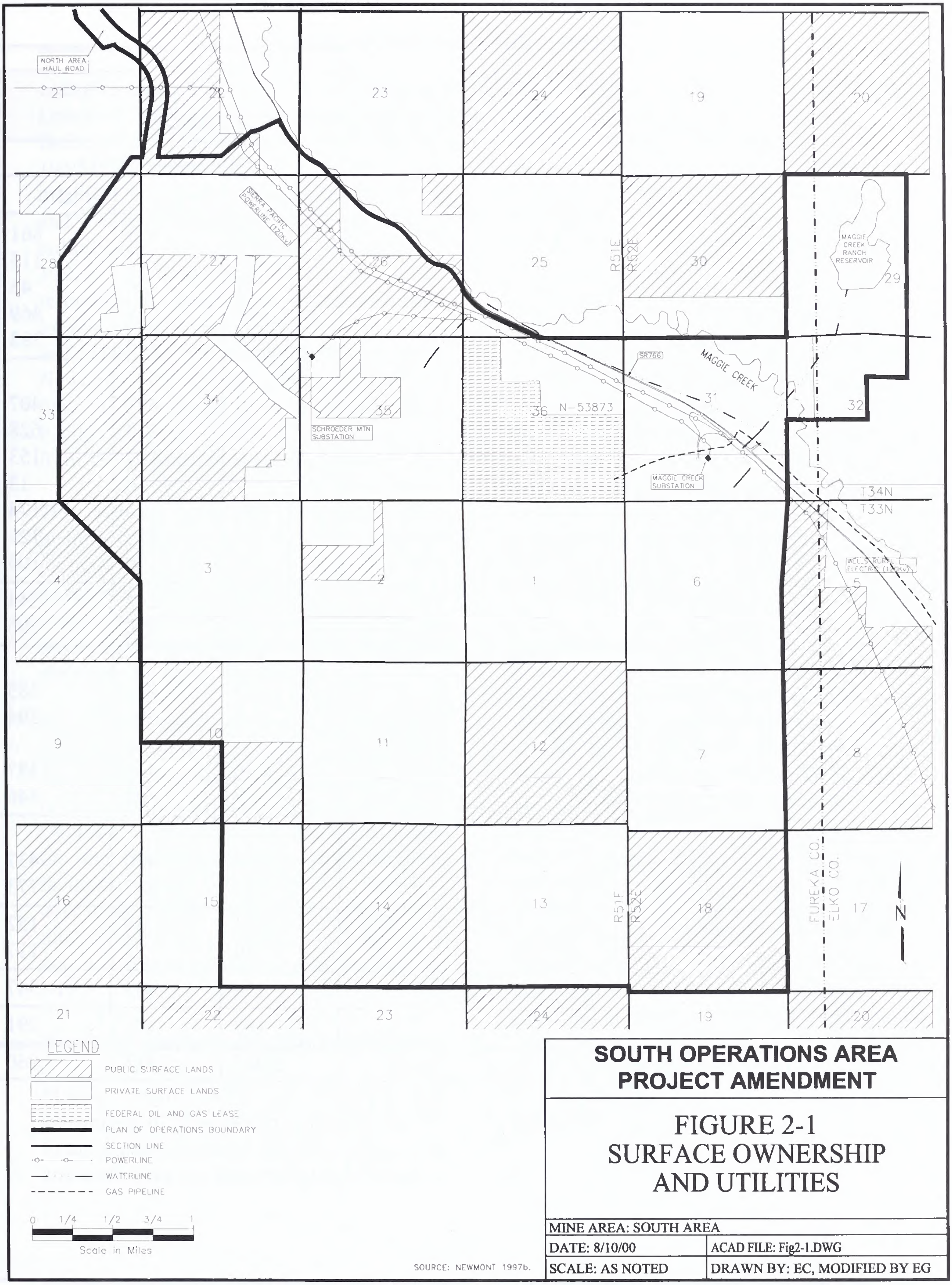
EXISTING OPERATIONS

This section describes Newmont's existing mining and processing operations in the South Operations Area. Location and land ownership, mining activities, processing facilities, water supply/mine pit dewatering, ancillary facilities/infrastructure, and current resource protection and monitoring activities relating to Newmont's existing operations are described below.

Location and Land Ownership

The South Operations Area is located at the eastern edge of the Tuscarora Mountains in the Maggie Creek Basin northwest of Carlin, Nevada. The facilities are located on 5,913 acres of private land and 2,047 acres of public (BLM) land in Township 33 North, Range 51 East; Township 33 North, Range 52 East; Township 34 North, Range 51 East; and Township 34 North, Range 52 East. **Figure 2-1** depicts surface ownership of lands and utilities, and **Table 2-1** shows the acreage of public and private lands disturbed under current authorization for each facility in the South Operations Area.

The existing facilities in the South Operations Area were designed, built, and are operated in compliance with the Nevada Administrative Code, <u>Regulation Governing Design, Construction, Operation and Closure of Mining Operations</u> (NAC 445A.350-445A.447), and other applicable state and federal regulations. Mining development in the South Operations Area has been ongoing since the Maggie Creek deposit was discovered in 1978. Development and construction of the Gold Quarry Mine and related support facilities were initiated in 1981. Mill 2 and the James Creek tailing facility processed the first ore from the Gold Quarry Mine in 1985. The Gold Quarry Leach Pad became operational in 1986. The second mill, Mill 5, was completed and



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 2-1
SURFACE OWNERSHIP AND UTILITIES

MINE AREA: SOUTH AREA	
DATE: 8/10/00	ACAD FILE: Fig2-1.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY EG

TABLE 2-1
EXISTING AND APPROVED SURFACE DISTURBANCE

Facility	Disturbance Acreage		
	Public	Private	Total
Gold Quarry Mine	239	622	861
Tusc Mine	93	22	115
Mac Mine	43	0	43
Haulage Roads	141	328	469
Dewatering Facilities	8	385	393
Waste Rock Disposal Facilities			
Gold Quarry North Dump	0	407	407
Gold Quarry South Dump	118	510	628
Maggie Creek Dump	0	153	153
James Creek Dump	0	13	13
Tusc West Dump	154	20	174
Tusc North Dump	11	110	121
Mac Dump	105	0	105
Processing Facilities	0	244	244
Ore Stockpile Areas	5	290	295
Leaching Facilities			
Gold Quarry Leach Pad	0	185	185
Property Leach Pad	0	294	294
Property Leach Pad 2	--	--	--
Non-Property Leach Pad	0	397	397
Refractory Leach Pad	243	103	346
Tailing Facilities			
James Creek tailing facility	7	430	437
Mill 5/6 tailing facility	436	337	773
Diversion Channels	113	39	152
Topsoil Stockpiles	29	88	117
Ancillary Facilities	114	833	947
Geologic Evaluations	188	103	291
Total Disturbance Acreage	2,047	5,913	7,960

commissioned in 1988. The South Area Leach Property and Non-Property leach facilities were constructed during 1988 and 1989. Beginning in 1993, Mill 2 was modified to process high grade refractory ore and was re-designated Mill 6. The Mill 5/6 tailing facility began receiving mill tailing in 1990. Newmont has built a low grade refractory ore demonstration leach facility, located on the Gold Quarry Leach Pad, to test and refine the refractory leaching process. Newmont has started construction of the foundation for the full-scale Refractory Leach Facility which is based on information gained from the demonstration facility.

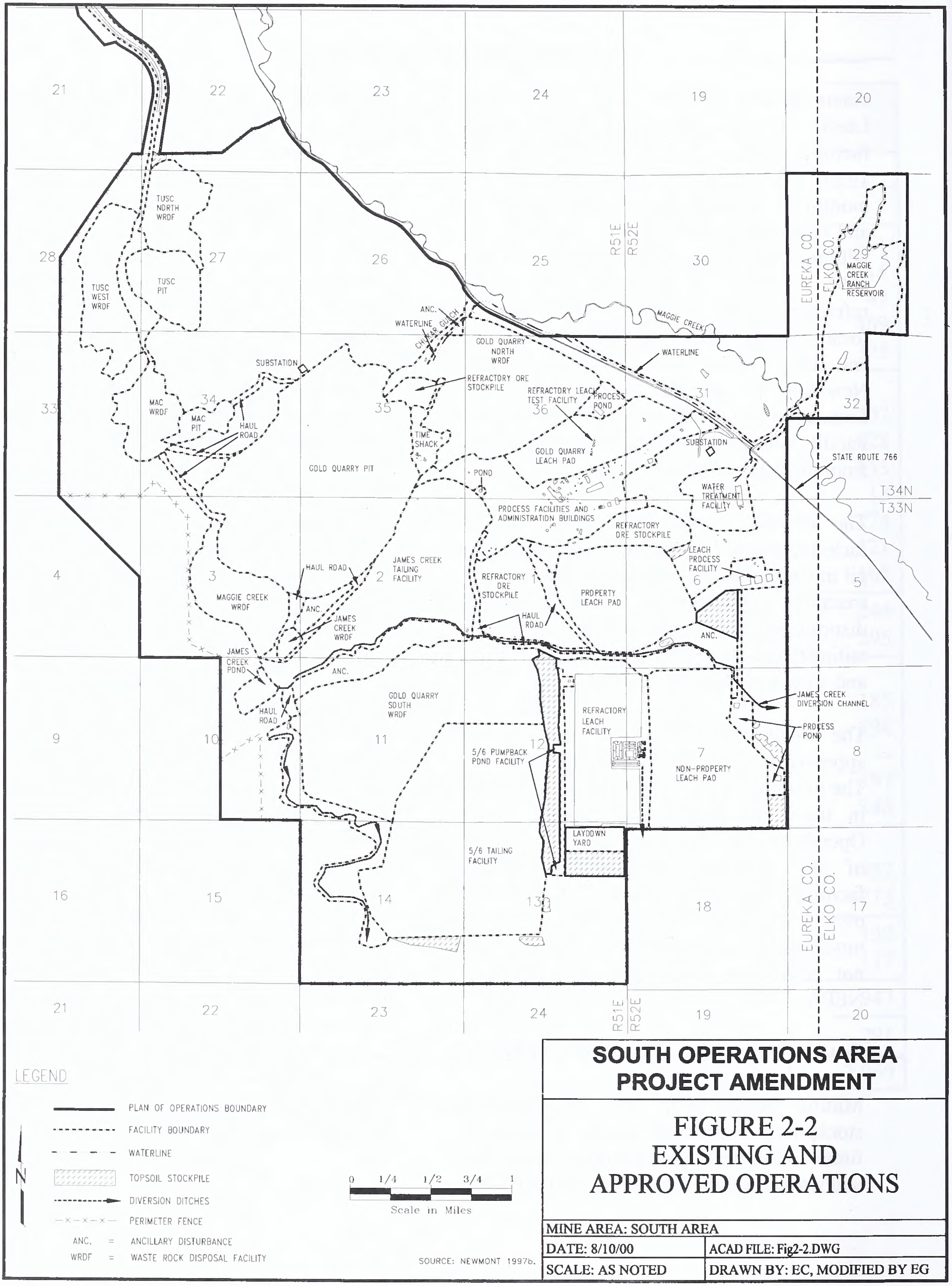
The existing permitted disturbance area includes the Gold Quarry, Mac, and Tusc open pit mines, haul roads and access roads, water treatment and disposal facilities, waste rock disposal areas, the James Creek and Mill 5/6 tailing facilities, mill facilities, leach facilities, and shop and office complexes.

The South Operations Area's existing and approved facilities are shown on **Figure 2-2**. The existing facilities are described in detail in the Draft EIS for Newmont's South Operations Area Project (BLM, 1993). Many of the facilities, particularly ancillary facilities, have been modified or relocated over time. The BLM has reviewed all modifications on public lands and they were not considered significant, as defined in NEPA.

South Operations Area Open Pit Mines

Mining begins with the recovery and stockpiling of available topsoil resources for future use in reclaiming disturbed areas. Ore and waste rock are then drilled and blasted in sequential benches to facilitate excavation, loading, and haulage. Rock samples, collected during blasthole drilling, are sent to Newmont's on-site analytical laboratory to determine metallurgical characteristics and gold grade. This information is used to supplement the original exploration data for both mine planning and operational control. Dependent upon metallurgical characteristics and gold grade, the blasted material can be sent to the oxide mill complex, refractory mill complex, oxide heap leach facilities, refractory leach facilities, refractory low grade ore stockpiles, or waste rock disposal areas.

Blasted ore and waste rock are loaded into large end-dump haul trucks, using either hydraulic shovels or front end loaders. The haul trucks deliver these materials to the designated location using a network of haul roads, both within and outside of the immediate open pit areas. Within the open pit mines, benches are established at approximately 25 foot vertical intervals. The width of each bench varies depending on whether the bench is in its final configuration or is to be used as a long-term working bench for roads and other activities. Haul trucks move within the open pit mine using temporary roads on the surface of each bench with ramps extending between two or more benches. Once the haul trucks leave the open pit mine, they travel on main haulage roads to deliver waste rock to the waste rock disposal areas and ore to Mills 5 and 6, heap leach pads, and stockpiles in the South Operations Area. These roads are bermed and maintained on a continuous basis to insure safe and efficient haulage operations and to minimize particulate dust emissions.



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 2-2
EXISTING AND APPROVED OPERATIONS

MINE AREA: SOUTH AREA	
DATE: 8/10/00	ACAD FILE: Fig2-2.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY EG

Gold Quarry Mine

The Gold Quarry Mine is an open pit mine in the South Operations Area with an historic production rate of approximately 83 million tons per year (tpy) of ore and waste rock. Under current approvals, the Gold Quarry Mine is projected to produce approximately 42 million tpy of ore and waste rock. The ratio of waste rock to ore is projected at 1.2:1. Under current approvals, the existing open pit mine extends approximately 7,500 feet northeast to southwest, 6,500 feet east to west, and approaches 1,455 feet in depth as measured from the pre-mining surface (the pit bottom elevation is approximately 3,375 feet above sea level).

Newmont operates dewatering wells in the South Operations Area to lower the ground water table below the bottom of the Gold Quarry Mine. The South Operations Area Project EIS analyzed ground water pumping rates of up to 42,000 gallons per minute (gpm) through year 2001 as approved by the Nevada Division of Environmental Protection (NDEP). Ore processing and dust control can consume up to 6,000 gpm of mine water. During the summer growing season, up to 5,500 gpm can be delivered to the T Lazy S Ranch lands for irrigation. The remaining water is treated and cooled, when necessary, to meet applicable permit effluent standards for discharge into Maggie Creek. Maggie Creek Ranch Reservoir is also used to store water during high flow periods in Maggie Creek and the Humboldt River.

Tusc Mine

The Tusc Mine is located 1.5 miles northwest of the Gold Quarry Mine. Permitted disturbance for the mine pit (500-feet deep), waste rock disposal facility (WRDF) and haul roads comprised 512 acres (BLM, 1993). The Tusc open pit mine is unaffected by this amendment.

Mac Mine

The Mac deposit is located 0.5 miles northwest of the Gold Quarry Mine. Permitted disturbance for the mine pit (400-feet deep), WRDF, and haul roads comprised 219 acres (BLM, 1993). The Mac open pit mine is unaffected by the proposed action, however, this pit will be analyzed for backfilling with waste rock from the Gold Quarry Mine.

South Operations Area Waste Rock Disposal Facilities

Up to 50 million tons of waste rock and overburden per year are generated by the South Operations Area mines. Waste rock is transported with haul trucks to the Gold Quarry North, Gold Quarry South, James Creek, Tusc, and Mac WRDFs. The waste rock is end-dumped down advancing, successive horizontal lifts, which vary in height from 10 to 100 feet. Slopes are established at the natural angle of repose. Each new lift on a waste rock facility is stepped back from the previous lift in order to facilitate reclamation and closure. Waste rock and overburden are also used as construction material for projects throughout the South Operations Area. The Maggie Creek WRDF is no longer active and has been reclaimed. The Tusc and Mac WRDFs will not be affected by the SOAPA.

South Operations Area Ore Processing Operations

The gold is associated with three basic ore types: oxide, sulfidic refractory and carbonaceous-sulfidic refractory. Oxide ore can be treated using industry standard cyanide extraction processes. The refractory ore typically requires pre-treatment to oxidize the ore prior to gold extraction; however, a portion of the low grade carbonaceous-sulfidic refractory ore will be leached directly with ammonium thiosulfate without pre-treatment. Ore processing facilities at the South Operations Area consist of Mills 5 and 6 and the Mill 5/6 tailing facility for high grade ore and leaching facilities for low grade ore. These facilities operate under authorization from the NDEP with the following Permit Numbers: Water Pollution Control Permit (NEV88011); Stormwater Discharge Permit (GNV0022225-10015); and Reclamation Permit (No. 0056).

Mill 5 - Oxide Ore Treatment Plant

The ore processing facilities at Mill 5 provide recovery of gold from high grade oxide ore through milling and cyanide extraction. The ore is hauled from the open pit mines to temporary stockpiles and blended for grade as it is fed into the primary crusher. The crushed ore is transferred to the Mill 5 feed stockpile. Crushed ore is conveyed to the mill facility for further size reduction and dissolution of the submicroscopic gold in cyanide solution. Activated carbon, added to the process, selectively adsorbs the dissolved gold from solution. The gold-loaded carbon is periodically removed from the system and transferred to the carbon and refining facility to remove the gold from the carbon. Final gold recovery involves retorting to recover mercury, smelting with flux to remove residual impurities, and casting into dore bars. The tailing or finely ground rock residue remaining after gold recovery is pumped to the Mill 5/6 tailing facility. The design and management of Mill 5 will remain unchanged by the proposed action. Throughput capacity of the mill is approximately 20,000 tpd.

Mill 6 - Refractory Ore Treatment Plant

The ore processing facilities at Mill 6 provide recovery of gold from high grade refractory ore through milling, roasting, and cyanide extraction. Ore is hauled, directly either from the mines or from existing stockpiles, to Mill 6. The ore is blended for both grade and metallurgical characteristics as it is fed into the primary crusher. The crushed ore is conveyed to the drying and grinding circuit for further size reduction. Dried ore is heated at high temperatures in the roaster plant to oxidize the refractory ore. A separate gas cooling and cleaning system is utilized to collect process off-gases and remove impurities from the roasting circuit gas streams. The associated sulfuric acid plant converts sulfur oxides in the off-gas stream to a salable product. The roasted ore is cooled and mixed with water to form a slurry. The ore slurry is then amenable to cyanide extraction as described for Mill 5. The design and management of Mill 6 will remain unchanged by the proposed action. Daily throughput capacity for the mill is approximately 8,000 tpd at present and may be increased to its design maximum of 8,500 tpd.

Mill 5/6 Tailing Facility

Tailing generated by the milling processes at Mills 5 and 6 is pumped to the Mill 5/6 tailing facility for disposal. The Mill 5/6 tailing facility is designed as a zero discharge facility, with all process solution and stormwater inflows being returned to the process system, lost through evaporation, or retained within the facility as interstitial moisture in the tailing material. Adequate freeboard is designed into the system to contain normal fluid volumes in the pond plus runoff from the tailing facility resulting from the 100-year/24-hour design storm event. The Mill 5/6 tailing facility has enough existing permitted storage capacity to accommodate the tailing resulting from the SOAPA. The tailing facility encompasses 773 acres, with a final embankment height of 230 feet, and a total capacity of 67 million cubic yards. The design and management of the Mill 5/6 tailing facility will remain unchanged by the proposed action.

South Area Leach Facility

Oxide leach operations in the South Operations Area are conducted at the Property and Non-Property leach facilities; two separate leach pads. The Gold Quarry Leach Pad (185 acres) is in the beginning stages of closure. All existing leach pads are located on private lands. The leach pads were constructed by clearing and contouring the original land surface, placing a low permeability clay subgrade, installing a synthetic liner, and placing a layer of fine-grained material to protect the synthetic liner and a coarse rock layer to provide drainage at the base of the ore.

Leach grade ore is hauled from the mine to the leach pad or to the leach crushing facility for size reduction. During size reduction, the crushed ore is mixed with lime and Portland cement or other agglomerating agents and water to agglomerate the fine ore particles. The ore is hauled to active leach areas on the South Area Leach Property (294 acres) and Non-Property leach pads (397 acres) and is dumped and spread on the leach pads in successive lifts approximately 30 feet high. Cyanide solution is applied to the uppermost lifts by continuous drip emitters or sprinklers, leaching both the newly added ore and the ore with residual gold contained in the underlying lifts. The leach pads drain to central collection points on the synthetic-lined pads where the solution flows into a lined pond. The solution is then pumped to a series of activated carbon columns. The gold-loaded carbon is periodically removed and sent to the carbon and refining facility to recover the gold.

Refractory Leach Facility

The current Plan of Operations authorizes construction of a production-scale Refractory Leach Facility, which would encompass 346 acres. Newmont recently (January 2000) completed constructing the Refractory Leach Facility. Depending on specific metallurgical characteristics, refractory ore will be processed using biooxidation, ammonium thiosulfate leaching and/or cyanide leaching. Facilities under construction include biooxidation and ammonium thiosulfate leach pads.

South Operations Area Ancillary Facilities

The ancillary facilities and infrastructure of the South Operations Area (2,053 acres) include access and haul roads; power distribution systems; processing facilities; mining and equipment maintenance shops; fueling areas; administrative offices; and dewatering and monitoring wells.

Facilities within the South Operations Area complex are linked by pipeline systems for distribution of potable water, mine water, ore processing solution, and tailing.

Water diversion ditches and channels within the South Operations Area divert surface water around the open pit mines, the Mill 5/6 and James Creek tailing facilities, leach facilities, and waste rock disposal facilities.

Existing Resource Monitoring

Air Quality

Newmont must sample ambient air for particulates 10 microns or smaller (PM-10) and monitor and record meteorological conditions at the sampling site as specified by the NDEP, Bureau of Air Quality. Emissions of concern (particulates, oxides of nitrogen, sulfur dioxide, and carbon monoxide) from existing operations are reduced through use of Best Management Practices (Handbook of Best Management Practices, Nevada State Conservation Commission, 1994). Examples include direct water application, the use of approved chemical binders or wetting agents, and revegetation of disturbed areas concurrent with operations. Sampling and monitoring have been conducted at the South Operations Area and will continue until active mining is complete. Findings are reported to the NDEP, Bureau of Air Quality within 60 days of the end of each quarter of the calendar year.

Air quality levels at the South Operations Area currently meet Nevada and federal standards.

Water Resources

Water resources in and around the South Operations Area are monitored within three hydrologic basins: Maggie Creek, Marys Creek, and Susie Creek. The current monitoring program addresses groundwater and surface water, including springs and seeps. Water quality and flows are measured routinely by Newmont at designated monitoring wells and surface water stations. Additional details on the hydrologic monitoring program at the South Operations Area are included in the Final EIS for the previous Plan of Operations Amendment (BLM, 1993). If impacts to water resources are observed in this area as a result of dewatering operations, a mitigation plan has been prepared and will be implemented (South Operations Area Project Mitigation Plan, BLM 1993). The South Operations Area Project Mitigation Plan (BLM, 1993) was prepared and will continue to be implemented if impacts to water resources are observed occurring as a result of the mining and processing activities and dewatering operations analyzed in the final EIS and approved for the 1992 plan of operations. Numerous mitigation measures in the 1993 mitigation plan have been implemented. Implementation of the Maggie Creek Watershed Restoration Project has provided

and continues to provide benefits to water resources, riparian areas and wetlands, and livestock pastures (BLM, 2000a). Please see **Appendix A** for more information (1999 Progress Report for the SOAP Mitigation Plan Implementation, Riparian Monitoring Analysis - Maggie Creek Watershed Restoration Project, and Photographs of Maggie and Coyote Creeks before and after restoration efforts).

Newmont has a permit issued by the NDEP to discharge ground water to Maggie Creek (up to 50,000 gpm). The water is cooled, monitored for quality and, when necessary, treated to remove naturally-occurring arsenic These data are reported in the Discharge Monitoring Reports for NPDES permit No. 0022268 which are available for inspection at NDEP.

Newmont has obtained a stormwater permit that regulates stormwater discharges from its facilities. Best Management Practices, developed by the Nevada State Conservation Commission, are used to control stormwater discharges. These include material handling practices that minimize the exposure of pollutants to stormwater; spill prevention and response; sediment and erosion control; and physical stormwater controls. Pursuant to applicable regulations, surface water diversion ditches will be constructed around the final perimeter of the pits and waste rock disposal facilities to prevent runoff from and run-on to these facilities.

Potentially Acid-Producing Rock

Newmont continues to sample, test, and classify the waste rock, in accordance with the NDEP Waste Rock and Overburden Evaluation guideline, to determine the potential of the mined waste rock to generate acid. Monitoring of stockpiled ore and waste rock with acid-producing potential is required by the NDEP. Site-specific plans are addressed in Newmont's "Refractory Ore Stockpile and Waste Rock Dump Design, Construction, and Monitoring Plan." These guidelines were developed to manage potential acid rock drainage through control of the acid generation process. Potentially acid generating waste rock that is identified is segregated, encapsulated, and monitored in accordance with the Plan.

Newmont has developed an intensive program designed to identify sources of potentially acid generating rock before they are removed during mining operations. This allows the planned mining of the rock and its placement in specially-prepared areas. These specific stockpiles and disposal areas are designed to prevent vertical migration of water and to contain lateral surface flows off the piles. Any drainage from these facilities is captured and used in the ore processing circuits. Ditches and berms are inspected quarterly and the stockpiles and disposal areas are inspected when flood conditions exist or have occurred. At closure, the potentially acid-generating rock would be totally capped to preclude drainage.

Hazardous Substances

The term "hazardous substance" is defined in 40 CFR 302.4 and the Superfund Amendments and Reauthorization Act (SARA) Title III (40 CFR 355). Hazardous substances are defined in 40 CFR 302 as "elements and compounds and hazardous wastes appearing in Table 302.4 are designated as hazardous substances under the Act." The Act is CERCLA or Superfund - Comprehensive Environmental Response, Compensation and Liability Act of 1980. Hazardous wastes are defined in 40 CFR 261. Hazardous substances that are transported, stored, or used onsite in quantities greater than the Threshold Planning Quantity designated by SARA Title III for emergency planning, are summarized in **Table 2-2**. Hazardous substances are transported to the South Operations Area by U.S. Department of Transportation regulated transporters (49 CFR 172) and stored onsite in approved containers (Newmont, 1997b). Spill containment structures are provided for storage containers. All hazardous substances are stored on private land.

The following hazardous substances may be transported, stored, and used at the South Operations Area in quantities less than the threshold designated by SARA Title III for emergency planning. The threshold for these substances is 10,000 pounds (BLM, 1993).

Acetone
Ammonium thiosulfate (5000 lbs)
Gasoline
Potassium permanganate
Ammonium hydroxide
Lead acetate
Sodium hydroxide solution
Calcium hypochlorite
Methyl ethyl ketone
Sodium hypochlorite
Mercury
Methyl chloroform
Solid sodium hydroxide
Freon
Methyl isobutyl ketone
Toluene

This list was derived from information provided by Newmont (1997c). Small quantities of hazardous substances not included in the above list may also be managed at the South Operations Area. These substances are components of commercially-produced paints, office products, and automotive maintenance products.

Hazardous Waste

The South Operations Area currently operates as a Large Quantity Generator of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). A RCRA Large Quantity Generator is a facility that generates more than 1,000 kilograms per month of RCRA-regulated hazardous waste (40 CFR Part 262). RCRA-regulated hazardous wastes generated at the South Operations Area and in associated management practices are included in **Table 2-3**.

All hazardous wastes currently generated by Newmont are handled according to existing, approved permits or are being disposed of according to local, state, or federal regulations.

TABLE 2-2
HAZARDOUS SUBSTANCES MANAGEMENT

Substance	Rate of Use	TPQ[1] (pounds)	Use	Amount Stored (typical)	Storage Method	Waste Management
Ammonium thiosulfate	7,058,500 lbs/year	NA	Oxidizing Ore	41,975 pounds	Bulk Tank	Consumed and converted by use
Sodium cyanide	4,800,000 lbs/year	100	Gold recovery process	400,000 pounds	Bulk tank solid	Portions are recycled or neutralized and left in place
Sulfuric acid	134,467,000 lbs/year produced by roaster	1,000	2 percent used in refinery acid digestion process	35,400 pounds	Bulk tank	Sold to 3rd parties off site
Hydrochloric acid	1,456,000 lbs/year	NA	Mill processing	47,800 pounds	Bulk tank	Returned to processing circuit
Hydrochloric acid	4,000 lbs/year	NA	Assay laboratory	218 pounds	One-gallon bottles	Returned to processing circuit
Nitric acid	660 lbs/year	1,000	Assay laboratory	100 pounds	One-gallon bottles	Returned to processing circuit
Diesel fuel	900,000 gal/month	NA	Equipment fuel	754,000 pounds	Bulk tanks	Spill containment

[1]TPQ = hazardous substance Threshold Planning Quantity designated by SARA, Title III (40 CFR 355).
NA = Not Applicable

Source: Newmont, 1997b and 1999.

TABLE 2-3
HAZARDOUS WASTE STREAMS[1]

Stream	Generator	EPA Hazardous Waste Code	TSDF[2]	Generation Rate[3] (pounds/year)
Paint-related materials	Mill 6	D001, F003	Laidlaw/Grassy Mt. by Incineration	4,000
Mercury PPE/debris[4]	Mill 6	D009	Laidlaw/Grassy Mt. by HW Landfill[5]	2,800
Spent MIBK[6]	Assay Lab	D001, D002	Laidlaw/Grassy Mt. by Incineration	350
Mercuric/Mercurous Chloride	Mill 6	D009, D002	Mercury Refining Retort Residues in HW Landfill	42,000
Mercury Solids	Mill 6	D009	Laidlaw/Phoenix by HW Landfill	4,000
Solvents	Mills, Leach	D001, F003	Laidlaw/Grassy Mt. by Incineration	8,000
Hydrochloric, Sulfuric Acid	Mills, Refinery	D002	Laidlaw/Grassy Mt. by Incineration	5,000
Caustic Solutions	Mills	D002	Laidlaw/Grassy Mt. by HW Landfill	2,000
Lab Packs[7]	Mills, Lab	varies	Laidlaw/Phoenix; varies	500
Lead-Bearing Waste	Assay Lab	D008	Laidlaw/Grassy Mt. by Incineration	256,000
Halogenated Oil	Mills	F002	Aragonite Aptus by Incineration	3,000
Mercury/Palladium Catalys	Mill 6	D009	Laidlaw/Grassy Mt. by Incineration	25,640

[1]Source: Newmont, 1997c.
[2]TSDF: Treatment, Storage, or Disposal Facility.
[3]Rate in 1997.
[4]Personal Protection Equipment
[5] Hazardous Waste Landfill.
[6] Methyl Isobutyl Ketone.
[7] Laboratory Clean-Out Chemical Wastes.

Solid Wastes

Newmont has an approved solid waste permit from NDEP, called a Class III Waiver, (Application #SWMI-07-18) for disposal of nonhazardous solid waste in their own landfill on site.

Some solid, nonhazardous wastes are transported to the Elko and Eureka County landfills.

Tailing Composition

The Mill 5/6 complex generates approximately 30,000 tpd of tailing, which is pumped via slurry pipeline to the Mill 5/6 Tailing Storage Facility. **Table 2-4** presents pH, metal, and cyanide concentrations in the South Operations Area tailing. These values are based on an average of metal concentrations for the Mill 5/6 solid tailing and average cyanide concentrations and pH values for the Mill 5/6 liquid tailing during 1996 (Newmont, 1997c).

Human Health and Safety

The South Operations Area is subject to the Federal Mine Safety and Health Act of 1977 which sets forth mandatory safety and health standards for surface metal and nonmetal mines, including open-pit mines. The purpose of these standards is the protection of life, promotion of health and safety, and prevention of accidents. Regulations promulgated under the act are codified under 30 CFR Subchapter N, Part 56. New employees at the South Operations Area are required by Newmont to receive training for specific tasks, for hazards, and to receive yearly refresher training.

Employment

Newmont presently employs approximately 2,950 people in Nevada: approximately 1,000 people at the South Operations Area Project.

Reclamation

Newmont filed a reclamation plan and amendments addressing mining activities in the South Operations Area (Newmont, 1992, 1996, 1997b, 1997d). This reclamation plan encompasses all existing disturbances in the South Operations Area. An amendment to that Plan, which addresses the Proposed Action, is discussed in the next section of this chapter.

PROPOSED ACTION

General Project Overview

The overview of project facilities and operations is summarized from the proposed Plan of Operations amendment filed by Newmont in 1997. The Plan of Operations contains detailed information on facilities, processes, and operations. This document is available for review at the Elko Field Office of the Bureau of Land Management.

The primary component of the SOAPA is the continued mining of the Gold Quarry ore body to recover both refractory and oxide gold ores. The Gold Quarry Mine would be expanded laterally and at depth. Proposed mining operations under the SOAPA would continue through the year 2011, and employment would remain at approximately 1,000 people.

TABLE 2-4
CONCENTRATIONS[1] OF TRACE ELEMENTS IN MILL TAILING

Solids				Liquids	
Parameter	**μg/g[2] (ppm)[3]**	**Parameter**	**μg/g (ppm)**	**Parameter**	**mg/L[4] (ppm)**
Arsenic	230	Sodium	300	pH (pH units)	8.55
Antimony	220	Thallium	11	Specific Conductance (μmhos/cm)	4,800
Barium	2,120	Strontium	330	Cyanide, WAD[5]	34.5
Beryllium	8	Tin	6	Cyanide, Free	18.3
Boron	31	Titanium	400	Cyanide, Total	47.8
Cadmium	4.7	Vanadium	900		
Chromium	65	Zinc	120		
Cobalt	3.8	Mercury	1.5		
Copper	65	Uranium	10		
Lead	90	Thorium	13		
Magnesium	170	Gold	3.0		
Manganese	33	Chlorine	11		
Molybdenu	48	Tungsten	14		
Nickel	81	Lithium	6.2		
Silver	5.2	Hafnium	10		
Selenium	240	Lutetium	0.47		
Thalium	0.67	Ytterbium	3.8		

1 Concentrations are based on the average concentration of trace elements in Mill 5/6 tailing.
2 μg/g = micrograms per gram (solids measurement unit).
3 ppm = parts per million.
4 mg/L = milligrams per liter (liquid measurement unit).
5 WAD = weak acid dissociable cyanide.

Source: BLM, 1993.

The Gold Quarry Mine operations would require the continuation of mine dewatering activities for the life of the project. During the period of proposed mining, dewatering would continue at flow rates lower than those analyzed in the South Operations Area Project EIS (BLM, 1993) (maximum of 42,000 gpm). Water treatment (if necessary), cooling, and discharge to Maggie Creek would continue.

The South Operations Area has seven WRDFs. The existing Gold Quarry North, Gold Quarry South, and James Creek WRDFs would be increased both laterally and vertically to provide capacity for the waste rock from the continued mining of the Gold Quarry Mine. The James Creek WRDF would encroach on land previously disturbed by the Maggie Creek WRDF. Approximately 10 percent of waste rock is used for construction projects in the South Operations Area (primarily non-acid generating material). The Tusc and Mac WRDFs will be unaffected by the proposed amendment.

High grade oxide ores produced from the Gold Quarry Mine would be processed at Newmont's existing Mill 5 through 1999. High grade refractory ores would be processed at Newmont's existing Mill 6. The existing Mill 5/6 tailing facility is adequately sized to accommodate the additional tailing from the Proposed Action.

Low grade oxide and refractory ore would require expansions to Newmont's South Area Leach processing facilities. Newmont would enlarge the Non-Property Leach Pad and Refractory Leach Pad and construct the Property Leach Pad 2 to process the Gold Quarry Mine low grade ore. **Table 2-5** presents predicted and past production rates.

An overview of the South Operations Area facilities including the proposed action is provided on **Figure 2-3**. Existing South Operations Area Project facilities are described earlier in Chapter 2.

Status of Lands Affected by Proposed Activities

Newmont seeks BLM approval for future activities in the South Operations Area that involve the use of public domain lands. These activities, which occur on both public and private lands, are discussed in detail below, including:

1. Continued mining of the Gold Quarry Mine;
2. Expansion of the Gold Quarry North, Gold Quarry South, and James Creek waste rock disposal facilities;
3. Expansion of the South Area Leach Facility;
4. Expansion of the Refractory Leach Facility; and
5. Construction of ancillary facilities.

These proposed activities would result in an incremental surface disturbance of 839 acres of public land, as shown in **Table 2-6**. **Table 2-7** presents the total surface disturbance with the amendment to the Plan of Operations.

The proposed operations are described in the following sub-sections, and shown in **Figure 2-3**. The proposed South Operation Area Project facilities have been designed to comply with all applicable provisions of the Nevada Administrative Code, Regulation Governing Design, Construction, Operation and Closure of Mining Operations (NAC 445A.350-445A.447), and other applicable

TABLE 2-5
PRODUCTION RATES (TONS)

	Material Type					
	Oxide Mill	Refractory Mill	Oxide Leach	Refractory Leach	Waste Rock	Total Material
Year 1	7,000	0	899,000	3,000	15,197,000	16,106,000
Year 2	147,000	0	2,888,000	60,000	36,899,000	39,994,000
Year 3	490,000	19,000	3,564,000	3,833,000	43,084,000	50,990,000
Year 4	1,791,000	37,000	1,386,000	3,220,000	43,117,000	49,551,000
Year 5	703,000	38,000	2,684,000	1,606,000	44,132,000	49,163,000
Year 6	425,000	24,000	5,136,000	2,047,000	40,832,000	48,464,000
Year 7	529,000	208,000	5,109,000	5,791,000	36,732,000	48,369,000
Year 8	1,349,000	91,000	7,312,000	7,335,000	31,510,000	47,597,000
Year 9	1,725,000	516,000	7,645,000	9,776,000	27,755,000	47,417,000
Year 10	689,000	1,369,000	4,394,000	9,816,000	30,928,000	47,196,000
Year 11	284,000	725,000	930,000	5,590,000	34,667,000	42,196,000
Year 12	76,000	861,000	75,000	10,204,000	16,949,000	28,165,000
Year 13	0	2,960,000	3,000	2,133,000	6,169,000	11,265,000
Total	8,215,000	6,848,000	42,025,000	61,414,000	407,971,000	526,473,000

Source: Newmont, 1997d.

TABLE 2-6
PROPOSED SURFACE DISTURBANCE

Facility	Disturbance Acreage		
	Public	Private	Total
Gold Quarry Mine	9	130	139
Tusc Mine	0	0	0
Mac Mine	0	0	0
Haulage Roads	-3	62	59
Dewatering Facilities	-8	-32	-40
Waste Rock Disposal Facilities			
Gold Quarry North WRDF	57	382	439
Gold Quarry South WRDF	205	30	235
Maggie Creek WRDF	0	-82	-82
James Creek WRDF	0	255	255
Tusc West WRDF	0	0	0
Tusc North WRDF	0	0	0
Mac WRDF	0	0	0
Processing Facilities	0	0	0
Ore Stockpiles	-5	-33	-38
Leaching Facilities			
Gold Quarry Leach Pad	0	-185	-185
Property Leach Pad	0	0	0
Property Leach Pad 2	163	0	163
Non-Property Leach Pad	182	0	182
Refractory Leach Pad	108	219	327
Tailing Facilities			
James Creek tailing facility	-7	-179	-186
Mill 5/6 tailing facility	0	0	0
Diversion Channels	54	84	138
Topsoil Stockpiles	116	82	198
Ancillary Facilities	-11	-179	-190
Geologic Evaluations	-21	-1	-22
Total Disturbance Acreage	839	553	1,392

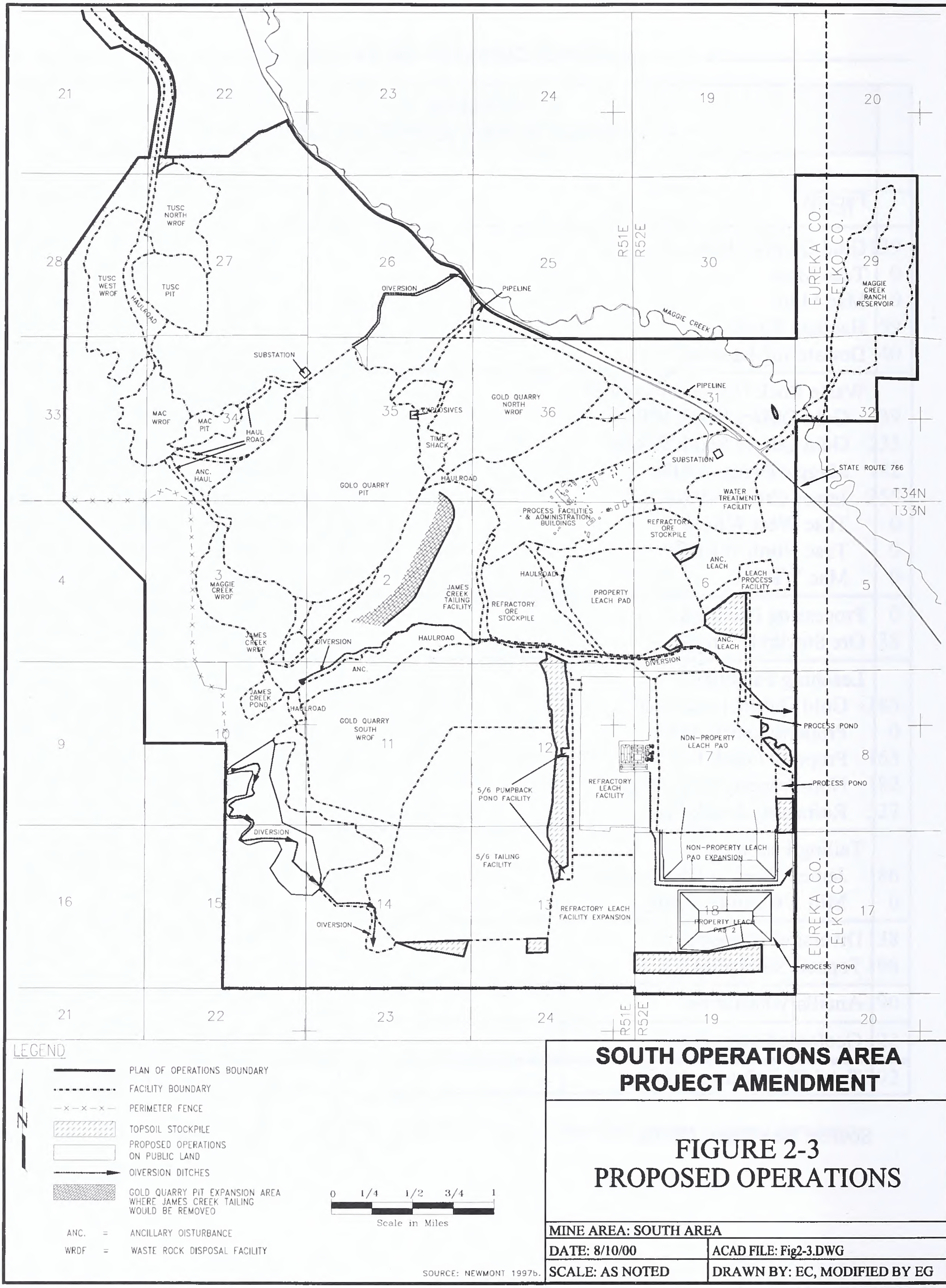
Note: Negative values are derived from existing disturbance that is incorporated into the proposed disturbance.

Source: Newmont, 1997d.

TABLE 2-7
TOTAL SURFACE DISTURBANCE

Facility	Disturbance Acreage		
	Public	Private	Total
Gold Quarry Mine	248	752	1,000
Tusc Mine	93	22	115
Mac Mine	43	0	43
Haulage Roads	138	390	528
Dewatering Facilities	0	353	353
Waste Rock Disposal Facilities			
Gold Quarry North WRDF	57	789	846
Gold Quarry South WRDF	323	540	863
Maggie Creek WRDF	0	71	71
James Creek WRDF	0	268	268
Tusc West WRDF	154	20	174
Tusc North WRDF	11	110	121
Mac WRDF	105	0	105
Processing Facilities	0	244	244
Ore Stockpile Areas	0	257	257
Leaching Facilities			
Gold Quarry Leach Pad	--	--	--
Property Leach Pad	0	294	294
Property Leach Pad 2	163	0	163
Non-Property Leach Pad	182	397	579
Refractory Leach Pad	351	322	673
Tailing Facilities			
James Creek tailing facility	0	251	251
Mill 5/6 tailing facility	436	337	773
Diversion Channels	167	123	290
Topsoil Stockpiles	145	170	315
Ancillary Facilities	103	654	757
Geologic Evaluations	167	102	269
Total Disturbance Acreage	2,886	6,466	9,352

Source: Newmont, 1997b.



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 2-3
PROPOSED OPERATIONS

MINE AREA: SOUTH AREA
DATE: 8/10/00 | ACAD FILE: Fig2-3.DWG
SCALE: AS NOTED | DRAWN BY: EC, MODIFIED BY EG

state and federal regulations. Newmont will apply to the NDEP for authorization to modify, as necessary, the existing Water Pollution Control Permit (NEV88011), Stormwater Discharge Permit (GNV0022225-10015), and Reclamation Permit (No. 0056) to begin operations. The existing mine water discharge permit (NEV0022268) would not require any modification as a result of this proposal.

Gold Quarry Mine

Both oxide and refractory gold ore would be mined concurrently from the Gold Quarry Mine. The continuation of mining would involve the removal of approximately 526 million tons of ore and waste rock over a 13-year period. Mining operations in the Gold Quarry Mine would generally involve the same operating practices currently utilized and described earlier in this chapter.

Proposed mining operations would increase the depth of the currently permitted Gold Quarry Mine by 350 feet to the 3,725-foot elevation. The pit expansion would occur along the eastern and southern perimeter. Dimensions from north to south would increase by approximately 800 feet to a total dimension of 7,500 feet. The SOAPA would encroach on 9 acres of public domain lands and 130 acres of private lands. Additional disturbance associated with the mine expansion would occur at the existing James Creek tailing facility, haul roads, and ancillary facilities. General acreages, dimensions, and capacities of facilities are presented in **Table 2-8**.

Additional haulage roads and extensions to existing roads are required to connect the Gold Quarry Mine to the waste rock disposal and ore processing facilities. Typical haulage roads would be approximately 200-feet wide. The haul road to the James Creek WRDF would be relocated after the tailing in the James Creek tailing facility are moved. The new haul road would be south of, and parallel to, the southern perimeter of the pit.

The proposed open pit expansion would require relocating 30 million tons of tailing from the James Creek tailing facility to the Mill 5/6 tailing facility. The existing Mill 5/6 tailing facility has adequate permitted capacity to contain this amount of tailing. Dredging has been determined to be the most efficient method of moving the tailing. Conventional surface mining techniques may also be used to move drier tailing on the periphery of the impoundment. Newmont would move the tailing material, over a period of 3 years, to create a geotechnically stable slope angle in the remaining tailing. The toe of the tailing slope would be established outside the crest of the open pit. An embankment along the common boundary with the Gold Quarry Mine would be constructed from mine waste rock and would have a compacted clay liner on the upstream (tailing-side) face. The embankment would not buttress the remaining tailing in the James Creek tailing facility, but would be designed to contain potential movement of tailing resulting from a seismic event. The embankment would be designed and constructed to withstand the maximum horizontal acceleration from seismic events as described in **Chapter 3**.

Mining of the Gold Quarry Mine would require the continuation of dewatering operations beyond year 2001 to keep the water table below the mine floor. Dewatering

TABLE 2-8
ACREAGE, DIMENSIONS, AND CAPACITIES FOR SOAPA FACILITIES AT END OF MINING

Facility	Acreage	Dimensions (feet) length x width x height[1]	Approximate Capacity (million tons)
Gold Quarry pit	1,000	7300 x 7500 x 1805 deep	---
Gold Quarry North WRDF	846	4000 x 4200 x 400	496
Gold Quarry South WRDF	863	1900 x 5050 x 200	217
Maggie Creek WRDF	71	2250 x 2600 x 120	30.5
James Creek WRDF	268	2000 x 3800 x 200	115
Ore Stockpiles	257	multiple	variable
Property Leach pad	294	3000 x 4000 x 200	118
Property Leach pad 2	163	2075 x 3125 x 300	46
Non-property Leach pad	579	6700 x 3700 x 300	245
Refractory Leach pad	673	3450 x 3550 x 100	61.4
Mill 5/6 tailing facility	773	4500 x 6750 x 125	67 million cubic yards
Diversion Channels	138	11,750 x 50	---
Topsoil Stockpiles	315	multiple <20 ft high	5.5 million cubic yards

Source: Newmont, 1997d.

[1]Average height above native ground surface. Length and widths are maximum but most facilities are irregularly shaped.

pumping rates of less than 30,000 gpm are forecasted during the life of the proposed project. Following completion of the Gold Quarry mining operations, pumping rates would continue for approximately 5 years, at a rate of 2,500 gpm, to support process operations.

Projected mine dewatering flow rates are based on results of a finite-element hydrologic model (HCI, 1999). The model used to support the SOAPA is based on the expansion and evolution of the original model used to support the South Operations Area Project EIS (BLM, 1993). Documentation of the final model can be found in HCI, 1992.

South Operations Area Waste Rock Disposal Facilities

The design criteria used to ensure stability of the project facilities are described in NDEP (1996). Waste rock disposal facilities, the new berm along the common boundary of the

pit and the James Creek tailing facility, leach pads, and mine pit slopes were designed in accordance with NDEP specifications for wet climate cycles, storm conditions, and earthquakes. Therefore, these facilities should have long-term stability following closure and reclamation.

The SOAPA is expected to generate approximately 408 million tons of waste rock. Based on the proportions of oxide and refractory ore produced, approximately 42 percent of the waste rock would be oxide and 58 percent refractory. The Gold Quarry North, Gold Quarry South, and James Creek WRDFs would be expanded to accommodate this additional waste rock.

The Gold Quarry North and South WRDFs are designed to accommodate potential acid generating waste rock produced by the Gold Quarry Mine expansion. Design guidelines, approved by the NDEP, are presented within Newmont's Refractory Ore Stockpile and Waste Rock Dump Design, Construction, and Monitoring Plan, as submitted to the NDEP and BLM (see Reclamation section above).

Monitoring of these facilities would be conducted as follows during operations and during the reclamation and closure. A quarterly inspection of refractory ore stockpiles and waste rock disposal facilities would be conducted to detect any possible abnormal conditions and to ensure the integrity of the ditches and berms. Diversion ditches around WRDF perimeters would be examined for indications of erosion or obstructions and any deficiencies would be corrected.

Refractory ore stockpiles and waste rock dump facilities would also be inspected following periods of heavy spring snow melt or a precipitation event with the potential for run-off. The purpose of inspection is to monitor the functioning of the facilities, detect any abnormal conditions, and anticipate the need for remedial actions. Observations of unusual flow or ponding would be reported to insure that solutions are analyzed, and contained or treated if necessary.

An inspection form would be used to document and guide the monitoring process. Items specifically monitored would include: 1) flow from the base of the waste rock disposal facility; 2) unusual ponding in the drainage collection ditch; 3) precipitates or staining on, or downstream of, the disposal facility; and 4) slope failure and exposure of potentially acid-generating waste.

Waste rock would be tested under procedures established by the State of Nevada in "Waste Rock and Overburden Evaluation", September 14, 1990. Waste rock samples would be combined into weight-averaged composites on a biannual basis and would be analyzed for leachability (Meteoric Water Mobility Procedure) and acid generation/acid neutralization potential. Evaluations of waste rock analyses would be included in permit-mandated Quarterly Water Reports for the facilities.

Gold Quarry North Waste Rock Disposal Facility

Newmont proposes to expand the Gold Quarry North WRDF to receive waste rock produced from the continued mining of the Gold Quarry Mine. The expanded Gold Quarry North WRDF would impact 57 acres of public domain lands and 382 acres of private land **(Table 2-6)**. This facility would also

encroach on private lands previously disturbed by ancillary facilities and stockpiles and would completely cover the Gold Quarry Leach Pad. This facility is currently inactive and in the beginning stages of closure, which include rinsing and decommissioning according to the closure plan approved by NDEP. The closure plan would be fully implemented prior to placing any waste rock on the decommissioned leach pad. The pipeline in Chukar Gulch would be removed prior to covering with waste rock.

Gold Quarry South Waste Rock Disposal Facility.

Newmont proposes to expand the Gold Quarry South WRDF to receive waste rock produced from the continued mining of the Gold Quarry Mine. The expanded Gold Quarry South WRDF would encroach on private lands previously disturbed by ancillary facilities and stockpiles would disturb an additional 205 acres of public domain lands and 30 acres of private lands (**Table 2-6**).

James Creek Waste Rock Disposal Facility

Newmont proposes to expand the James Creek WRDF located on the southwest side of the Gold Quarry Mine. The expanded James Creek WRDF would encroach on private lands previously disturbed by the Maggie Creek WRDF, James Creek tailing facility, haul roads, and ancillary facilities and would disturb an additional 255 acres of private land (**Table 2-6**).

South Area Leach Facilities

The existing oxide leach facilities in the South Operations Area would be expanded to accommodate the low grade oxide and biooxidized sulfidic refractory ore from the proposed Gold Quarry Mine expansion. The South Area Leach facility expansion would consist of a southern extension of the existing Non-Property Leach Pad and construction of the Property Leach Pad 2. The leach pads would continue to be stacked in lifts to a maximum height of 300 feet. The expansions would be located in Section 18, T33N R52E and would be loaded using either conventional haulage trucks or a conveyor system. Process and stormwater ponds would be constructed down gradient of the proposed leach pads. The proposed leach pads would share the same process and stormwater ponds. All ponds would be fenced in compliance with Nevada Division of Wildlife (NDOW) specifications.

The Non-Property Leach Pad would be expanded along its existing southern edge and would disturb 182 acres of public lands (**Table 2-6**). The expansion would buttress against the existing Non-Property Leach Pad and would ultimately contain approximately 245 million tons. The Property Leach Pad 2 would be operated independently from the existing Property Leach Pad. The proposed Property Leach Pad 2 including process and stormwater ponds would disturb 163 acres of public lands and would contain approximately 46 million tons. The diversion ditch from Section 7 to Section 18 T33N, R52E, would be extended around the south side perimeter of the non-property Leach Pad expansion. The new process ponds would be made safe for wildlife according to NDOW regulations. Newmont's Plan of Operations would use the technique of maintaining the solutions at concentrations below levels considered lethal to wildlife. **Figure 2-3** shows the location of the proposed Non-Property Leach Pad expansion, Property Leach Pad 2, and the

process and stormwater ponds. **Figure 2-3** also shows the perimeter fence that was modified in the Plan of Operations Amendment of 12/12/97 (Newmont, 1997d).

Refractory Leach Facility

Newmont proposes to construct an expansion to the Refractory Leach Facility to provide both a biooxidation leach pad and an ammonium thiosulfate leach pad for heap leaching the carbonaceous sulfidic refractory ore in lifts without removing it from the pad. New process ponds for the refractory leach facility would be made safe for wildlife according to NDOW regulations. Newmont's Plan of Operations would use the technique of maintaining the solutions at concentrations below levels considered lethal to wildlife. This proposed Refractory Leach Facility expansion would disturb an additional 108 acres of public land and 219 acres of private land (**Table 2-6**). Newmont has begun construction on the private land where they have approval to construct from the 1993 Record of Decision. The need for additional refractory leach area had not arisen until recently.

Ancillary Facilities

Expansion of the primary facilities would require very limited expansion of ancillary facilities, including access roads, lay down yards, water and solution pipelines, water quality monitoring wells, surface water diversion ditches, and power distribution systems. The perimeter fence would be expanded to include all new facility expansion (**Figure 2-3**).

Water Treatment Facility

If necessary to meet water quality standards, the existing permitted water treatment system could be reactivated from its inoperative status. The treatment facility has not been needed for several years. The water treatment facility utilized a chemical precipitation process to reduce metal concentrations in dewatering effluent to be discharged to Maggie Creek. Lined ponds have been constructed in which chemical precipitation and clarification of the water takes place. Sludge resulting from the chemical precipitation process would be periodically pumped from the bottom of each treatment pond and trucked to the tailing facility for disposal. Chemicals used in the water treatment facility included ferric sulfate, flocculants, and coagulants. Only minor amounts are currently stored on site.

The cooling tower installed east of Highway 766 would continue to be used when necessary to reduce the temperature of treated discharge waters such that water temperature of the Humboldt River at the confluence of Maggie Creek would be maintained within 2° C of ambient water temperature (State of Nevada water quality standard). Newmont's NPDES permit allows discharge into Maggie Creek with temperatures up to 77 degrees Farenheit.

Water Control Ditches

The SOAPA provides for construction of water control ditches for each new or modified facility. Existing diversion ditches would be maintained in accordance with NDEP requirements.

Pursuant to applicable regulations, surface water diversion ditches would be constructed around the final perimeter of the pits and WRDFs to prevent runoff from and run-on to these facilities. The diversion ditch above the South WRDF in Sections 10, 11, and 14, T33N, R52E, would be relocated to the west, as shown in **Figure 2-3**. Comparing **Figures 2-2 and 2-3** illustrates this relocation.

Best management practices for control of surface erosion and sedimentation from disturbed areas would be implemented at new disturbance sites (e.g., netting, straw bales, sediment control ponds). Flow of surface water would be directed around waste rock disposal areas, leach pads and the tailing impoundment. After closure and reclamation, all runoff would be directed back to natural drainage.

Resource Monitoring

Air Quality

Air resource monitoring would continue pursuant to current permits and regulations as discussed in Resource Monitoring under Existing Operations.

Water Resources

Hydrologic monitoring of surface water, groundwater, and springs/seeps in the study area would continue under the Proposed Action. The Maggie Creek Basin Monitoring Plan (Newmont, 1999c) and the monthly hydrographs would continue to provide a means of evaluating potential impacts during and after mining. Monitoring wells are used to measure water levels and/or water quality. As a result of the South Operations Area Project EIS, spring and seep monitoring would be changed and would continue with annual monitoring in the fall to evaluate changes in flow and water quality. Surface water monitoring would continue to be conducted on six streams and the Humboldt River. Monitoring of water resources would continue after cessation of mining activities in the South Operations Area. Spring flow mitigation would continue at impacted springs until the applicable trigger well returns to within 10 feet of its pre-impact level (based on existing monitoring data), or until the BLM determines that mitigation is no longer necessary, whichever is sooner (BLM, 1993). Because the Carlin "Cold" Springs are the primary source of water for the town of Carlin, Newmont has agreed to maintain an adequate supply of potable water should any deficiency occur due to dewatering activities. See Appendix A for a progress report on implementation of the SOAP Mitigation Plan.

As a result of the combined groundwater drawdown effects area between Newmont's South Operations Area and North Operations Area, and Barrick Goldstrike's Betze Mines, several streams north of the South Operations Area that are tributary to Maggie Creek could be affected by flow reductions (see Chapter 5, Cumulative Effects). Therefore, a cooperative monitoring program would be established for these two mining companies to evaluate potential impacts to these streams.

Potentially Acid-Producing Rock

Monitoring of waste rock and sulfide ore stockpiles would continue according to existing permits and regulations, as discussed in Resource Monitoring under Existing Operations. New refractory ore stockpiles and waste rock dump facilities would be designed and constructed in a consistent manner

throughout the South Operations Area Project. These practices are intended to minimize potential for acid drainage by control of the acid generation process. In general, these procedures are based on the strategy that acid generation can best be prevented by minimizing the amount of water which contacts potentially acid generating rock. Both refractory ore stockpiles and sulfide waste dumps are designed and constructed to limit the exposure of sulfidic material to atmospheric oxygen, groundwater, direct precipitation, snow melt and storm-water run-on.

The SOAPA plans on mining approximately 58 percent refractory ore and 42 percent oxide ore over the project life. While this would result in more potentially acid producing waste rock than neutral or acid-consuming waste rock, the proposed plans for encapsulation would still be applicable. The illustrations accompanying the Refractory Ore Stockpile and Waste Rock Dump Design, Construction and Monitoring Plan show two means of encapsulation, a hillside configuration and a basin configuration. Both configurations indicate encapsulation of large volumes of potentially acid-producing rock with smaller volumes of oxide waste and neutralized waste rock, respectively.

Access for snow removal is an integral part of dump and stockpile design and construction. When necessary, snow would be removed from the top surface of the stockpile and placed outside the diversion ditch boundary to limit the amount of snow melt infiltration and runoff collected in the ditches. The procedure for controlling acid generation includes:

Potentially Acid Generating Waste

1. Segregation and placement of sulfide wastes in internal areas of waste rock dumps above a prepared base.
2. Total enclosure or encapsulation of the sulfidic waste zone with non-acid producing material.
3. Careful sloping and random wheel compaction of individual lift surfaces.
4. Control of surface water flows to prevent infiltration.
5. Placement of a low permeability cap over the final encapsulation cell.
6. Reclamation of waste rock disposal facilities, including establishing vegetation, to minimize water infiltration.
7. Collect all drainage from facility and use it in processing. Processing would continue for more than five years after waste rock generation ceases.
8. After mining ceases, all potentially acid-generating material would be fully encapsulated and a low permeability cap placed over the disposal facility and no acid rock drainage is expected to occur.

Refractory Ore

1. Placement of refractory ores on a low permeability base.
2. Careful sloping and random wheel compaction of individual lift surfaces.
3. Control of surface water flows to prevent infiltration.
4. Collect all drainage from facility and use it in processing.

Wastes - Solid or Hazardous

Hazardous Substances

Newmont does not anticipate an increase in the present levels or types of hazardous substances transported, stored, used, treated, recycled, or disposed of on-site at the South Operations Area. Hazardous substance management is described in Hazardous Substances under Existing Operations in this chapter.

Tailing Composition

The Proposed Action is expected to generate tailing from two sources: the existing Mill 5 and Mill 6. Mill 5 would continue to generate tailing composed primarily of finely ground rock and weak cyanide aqueous solution with a daily production of approximately 10,500 tons. The combined tailing would also receive a small volume of material generated by the refining facilities. The tailing would be similar in composition to the tailing generated by current operations (**Table 2-4**).

Mill 6 would continue to generate a tailing similar to that of Mill 5. Mill 6 operations are expected to generate approximately 10,000 tons per day of tailing material. Most solution would be reclaimed from the tailing and reused in the milling process.

Human Health and Safety

Human health and safety programs and requirements would be the same as those described in Human Health and Safety under Existing Operations in this chapter.

Closure and Reclamation

Newmont has committed to a comprehensive reclamation plan in order to achieve post-mining objectives of livestock grazing, wildlife habitat, and recreational use. This reclamation would entail establishing a self-sustaining, high quality, diverse ecosystem on most disturbed land. The reclamation plan includes: detoxification of heaps; drain down and evaporation of process water; regrading of haul roads, waste rock disposal areas; heap leach pads, tailing impoundments, tailing embankments, process ponds, and ancillary facility areas; erosion and sedimentation control measures; and topsoil replacement. Amendments and fertilization, seeding, and post-reclamation monitoring to ensure stabilization and revegetation is successful would also be completed.

Reclamation activities described in this section address both existing mine lands and lands included in the SOAPA. As various facilities, including the mine pit, waste rock disposal areas, leach heaps, and ancillary facilities, reach the end of their useful lives, Newmont would institute appropriate closure methods for these facilities. In compliance with the BLM and NDEP regulations 43 CFR 3809 and NAC519A, respectively, Newmont has filed a reclamation plan entitled Gold Quarry Operations Area Reclamation Plan, May 1996 and two amendments in 1997. The plan encompasses disturbances associated with the existing South Operations Area activities. The reclamation schedule proposes final revegetation activities ending in 2017.

Reclamation activities include closure of tailing and heap leach facilities, installation of pit fencing or berms, removal of structures not

needed after cessation of operations, regrading of disturbed areas (including waste rock piles and roads), drainage control, replacement of salvaged soils, revegetation, closure of water and monitoring wells not needed after cessation of operations, and reclamation monitoring.

Soil Salvage

Newmont has salvaged topsoil from previously authorized disturbance areas and would continue to salvage topsoil in areas to be disturbed by the SOAPA. Most previously salvaged topsoil has been stockpiled for use in later reclamation although some topsoil has been used in ongoing reclamation at the mine. Topsoil stockpiles would be located throughout the South Operations Area in proximity to sites that eventually would be reclaimed. Major proposed topsoil stockpiles are shown in **Figure 2-3**. Topsoil stockpiles are protected from wind and water erosion through establishment of vegetative cover.

Newmont proposes stripping an average of 12 inches of topsoil from newly disturbed mine areas, resulting in a volume of approximately 2.2 million cubic yards. For Newmont to cover all proposed disturbances with approximately 6 inches of topsoil would require 1.1 million cubic yards. The excess soil resource would be available for use on other existing disturbance areas.

Newmont has identified four stockpile locations for the Proposed Action. These topsoil stockpiles would cover approximately 116 acres of public land and 82 acres of private land adjacent to the respective disturbance areas. These acreage figures have been included within the Incremental Disturbance Acreage figures outlined in **Table 2-6**. The four topsoil stockpiles would have the capacity to store more than the 2.2 million cubic yards proposed for salvage (up to 2.6 million cubic yards of material at an average height of 8 feet).

Revegetation

A test-plot program has been implemented to evaluate and select successful, site-specific reclamation measures. These measures included different aspects and soil types. Various surface preparation practices were also evaluated for their success in promoting plant establishment and resistance to soil erosion. Areas undergoing concurrent reclamation within Newmont's mining operations are being utilized as the test plots. The reclamation studies were developed in cooperation with BLM, NDEP, and NDOW. Based on the results, plant mixtures and cultivation practices were selected for reclaiming disturbed areas.

Disturbed areas would be ripped and scarified to a minimum depth of six inches and a maximum depth of three feet, with ripper blades approximately 52 inches apart. The surface would be ripped a total of three times, parallel, perpendicular, and diagonally. This method averages a depth of 12 and 18 inches over the surface to promote revegetation. The open pit would remain open, but would be restricted from public access with fences and/or berms to ensure public safety.

Organic amendments may be used to enhance reclamation success. Organic amendments such as fertilizers or mulch may include straw, manure, sludge, or decomposed plant material.

On steeper slopes, mulch would be held in place by chemical tackifiers. If mechanical

equipment is employed, mulch would be applied and crimped after seeding.

Newmont would develop a seedbed using the most appropriate techniques determined during concurrent reclamation. The surface would then be broadcast, drill, or aerial seeded depending on the slope of the surface. As part of the test-plot program, seed mixtures would be developed so that a mosaic pattern of three to four seed mixtures could be seeded on mine disturbances. **Table 2-9** presents the master seed list from which seed mixtures would be developed. Application rate would be from 6 to 15 pounds of pure live seeds per acre. Non-native species would be used only whenneeded for soil stabilization early in revegetation operations.

Noxious Weed Control

Newmont conducts annual weed surveys and uses that information to help implement their ongoing weed control program. Survey results would indicate where weed populations are expanding or where new populations are getting established. Resources to control weeds are then allocated according to the priorities of the control program. Newmont uses several methods to control weeds, including spraying, mowing, and covering (occasionally earth moving activities literally cover infested sites).

Mine Pit

Reclamation activities for the Gold Quarry pit would include constructing diversion channels to minimize surface water runoff into the pit, constructing berms around the pit to prohibit access, and posting warning signs to identify potential safety hazards. In the event the pit is fenced, it would be with either a 4- or 5-strand barbed wire fence. All direct access for the pit would be eliminated. The formation of a lake in the pit is described in Chapter 4. The project area perimeter fence would be maintained through the completion of successful reclamation.

Waste Rock Disposal Areas

Waste rock would be placed by end-dumping an advancing face in successive horizontal lifts averaging 100 feet in height, which would vary in height depending on topography. Based on geotechnical and erosional stability criteria, the final reclamation configurations for the waste rock disposal areas would include regrading of slopes to achieve an overall slope of approximately 2.5H:1V. Overall slope is defined as the total change in elevation from beginning top crest to final bottom toe, divided by the corresponding horizontal distance between. The top surface and bench surfaces are designed to promote runoff.

The waste rock disposal facilities are designed and constructed using a conservative calculated factor of safety, which minimizes the potential for failure. Grading would minimize the potential for mass failures or rill erosion, facilitate reclamation activities, and promote better vegetation establishment. Sharp edges would be rounded off by regrading, resulting in the development of undulating slopes.

Potentially acid generating waste rock would be excavated during mining operations. This material would be encapsulated with non-acid-generating material to prevent the potential to generate acid or mobilize contaminants pursuant to Newmont's "Refractory Stockpile and Waste Rock Dump Design and Construction Guideline" and

TABLE 2-9
SEED LIST

Thickspike wheatgrass *Agropyron dasystachyum*	Pubescent wheatgrass *Agropyron trichophorum*
Streambank wheatgrass *Agropyron riparium*	Bluebunch wheatgrass *Agropyron spicatum*
Sandberg bluegrass *Poa sandbergii*	Indian ricegrass *Oryzopsis hymenoides*
Webber ricegrass *Oryzopsis webberi*	Idaho fescue *Festuca idahoensis*
Green needlegrass *Stipa viridula*	Bottlebrush squirreltail *Sytantion hystrix*
Great Basin wildrye *Elymus cinereus*	Crested wheatgrass *Agropyron cristatum*
Sheep fescue *Festuca Ovina*	Western wheatgrass *Agropyron smithii*
Slender wheatgrass *Agropyron trachycaulum*	Canby bluegrass *Poa canbyi*
Sand dropseed *Sporabolus cryptandrus*	Alkali sacaton *Sporabolus airoides*
Yellow sweetclover *Melilotus officinalis*	Cicer Milkvetch *Astragalus cicer*
Northern sweetvetch *Hedysarum boreale*	Buckwheat *Eriogonum* sp.
Common sainfoin *Onobrychis viciaefolia*	White sweetclover *Melilotus alba*
Alfalfa *Medicago sativa*	Annual ryegrass *Lolium perenne multiflorum*
Barley *Hordeum* sp.	Western yarrow *Achillea millefolium*
Small burnet *Sanguisorba minor*	Blue flax *Linum lewisii*
Gooseberryleaf (Scarlet) Globemallow *Sphaeralcea grossulariaefolia*	Scarlet globemallow *Sphaeralcea coccinea*
Palmer penstemon *Penstemon palmeri*	Big Sagebrush *Artemisia tridentata var. tridentata, wyomingensis*

TABLE 2-9 (continued)
SEED LIST

Chokecherry *Prunus virginiana*	Black sage *Artemisia nova*
Shadscale *Atriplex confertifolia*	Fourwing saltbush *Atriplex canescens*
Prostrate summer cypress *Kochia prostrata*	Serviceberry *Amelanchier (alnifolia) (utahnsis)*
Winterfat Ceratoides lanata	Rubber rubbitbrush *Chrysothamnus nauseosus*
Mormon tea *Ephedra (nevadensis) (viridis)*	Antelope bitterbrush *Purshia tridentata*
Snowbrush *Ceanothus spp.*	Currant *Ribes spp.*
Woodsrose *Rosa woodsii*	Snowberry *Symphoricarpos spp.*

Source: Newmont, 1996.

"Refractory Stockpile and Waste Rock Monitor Plan." Newmont stores or would store potentially acid generating waste in the Gold Quarry South WRDF, Gold Quarry North WRDF and the Refractory Leach foundation. Revegetation would then be carried out as previously described. Potential upgradient run-on to each waste rock disposal area is or would be diverted by designed drainage ditches. Each channel is or would be designed to contain discharge from the 100-year 24-hour storm event and direct the flow into natural drainages downgradient from each disposal area.

Tailing Storage Facility

The existing James Creek tailing facility would be disturbed to allow expansion of the Gold Quarry pit, and the modified tailing facility would require reclamation. The James Creek facility would be reduced in volume by hauling tailing to the Mill 5/6 tailing facility. After removing tailing from the northwest margin of the tailing facility, a new embankment would be constructed to retain the remaining tailing in the James Creek facility, and existing, approved drainage controls would be reestablished. Then reclamation of the new embankment and the surface of the modified James Creek tailing facility would be conducted. The new surfacewould be graded, topsoil would be spread, seed would be applied, and fertilizer and mulch would be applied to complete the revegetation process.

The reclamation plan for the Mill 5/6 tailing impoundment includes the following. Once the surface is capable of supporting equipment, it would be graded to reduce irregularities with a final slope of less than 1 percent toward the southwest, where a closed basin would then be formed within the tailing

embankment. Existing berms upslope of the disposal facility would limit water run-on to the surface of the tailing facility so that only precipitation would enter the closed basin. The basin would be designed to contain the design storm event and evaporation would remove the water. Sideslopes for the storage facility would be fertilized and covered with 6 inches of previously salvaged topsoil. Topsoil available for spreading is limited to the amount salvaged prior to operations. Newmont's Reclamation Plan (as amended) states that topsoil will be spread at depths from 0 to 12 inches, depending on site-specific conditions. The tailing storage facility would be broadcast seeded, fertilized, and mulched using straw and other materials. It is expected that continuous seepage of residual tailing solution would cease several years after tailing deposition is halted and final closure and remaining reclamation could then be completed.

Natural degradation processes would be expected to reduce the cyanide concentration in the seepage to below the present regulatory criterion of 0.2 milligrams per liter (mg/L) weak acid dissociable cyanide and stabilize the pH at between 6 and 9 standard units. High-density polyethylene pond liners beneath seepage collection ponds would be folded and buried at least 5 feet below the backfilled surface. Backfilled areas would then be revegetated. Newmont (1996) presents additional information on reclamation of the tailings storage facility.

Leach Pads

The following heap leach facilities are associated with this amendment:

- Non-Property Leach Pad expansion;
- Property Leach Pad 2; and
- Refractor 4 Leach Facility expansion.

The Non-Property pad expansion and the Property Leach Pad 2 pad utilize the cyanide method of gold extraction. The Refractory Leach Facility expansion utilizes an ammonium thiosulfate extraction process that would not require neutralization/ detoxification. This material type is currently treated as potentially acid generating waste in the bioleach demonstration facility. This material type is currently, and would continue to be, encapsulated with non-acid-generating material to prevent the potential to generate acid or mobilize contaminants pursuant to Newmont's "Refractory Stockpile and Waste Rock Dump Design and Construction Guideline" and "Refractory Stockpile and Waste Rock Monitoring Plan." The Refractory Leach Facility has been designed for removal of spent ore, whereas the expansion facility for oxide material would remain in place for encapsulation.

Spent ore on the oxide heap leach pads utilizing the cyanide process would undergo detoxification and neutralization procedures prior to reclamation. Detoxification and neutralization are required to reduce the weak acid dissociable (WAD) cyanide concentration level to less than 0.2 mg/L and to reduce the pH to between 6 and 9, as required by NAC 445A.430, in addition to meeting drinking water standards established for the state.

The rinsing phase would be conducted concurrently with the final gold producing leach activities. It is anticipated that gold can be produced for approximately three years after ore loading ceases. Detoxification would commence during this time period. The heap leach pads would be allowed to drain freely to reduce the volume of solution in circulation during rinsing. The drained solution would be recirculated or discharged to the tailings impoundment until low pH and increased water quality levels are reached. Rinsate

would be recirculated through the ore until the criteria of less than 0.2 mg/L WAD cyanide level and pH of 6 to 9 are achieved.

If reasonable attempts to reduce WAD cyanide levels or other constituent levels in the spent oxide heaps are not successful, Newmont would submit proposals to the NDEP for alternatives to meet levels acceptable to the NDEP.

All rinsate, residual liquor, and rain and/or snowmelt would be collected from the spent heaps following completion of detoxification and neutralization procedures for appropriate disposal through the use of passive treatment or evaporation. At the completion of all detoxification/neutralization and evaporation procedures, the collection system would be removed and reclaimed according to the following sections.

The Refractory Leach Facility expansion would be encapsulated and reclaimed following final gold extraction. The cyanide process pads would be reclaimed following detoxification and neutralization. Side slopes would be regraded to achieve an overall slope of 2.5H:1V. This overall slope would be achieved by regrading inner ramp slopes to 2.3H:1V with 10-foot benches remaining for approximately every 50 feet of elevation change. Where lift heights and bench widths vary, regrading would be performed to provide a maximum overall slope of 2.5H:1V. The top surface and bench surfaces would be graded to promote runoff. Growth media is limited within this operation area; therefore, alternative amendments may be used as mentioned in the revegetation section.

Potential run-on to the heap leach pads would be collected and conveyed off and away from the area via drainage ditches. Heap leach pads would have associated trapezoidal-sectioned drainage ditches designed to collect and convey the 100-year 24-hour storm event.

The following process and stormwater ponds are associated with this amendment:

- Property Leach Pad 2 pregnant solutions and storm events ponds; and
- Refractory Leach expansion ore pregnant solution and storm events ponds.

Solutions present in the pregnant solution ponds would be stabilized and neutralized concurrently during detoxification and neutralization of the heap leach material. The ponds would remain operational until all detoxification and neutralization procedures are completed.

Reclamation of each of the lined ponds would be similar in method. Impounded water or solution present at the end of operations would be disposed of either by evaporation, as would be the case for solutions present in the pregnant solution ponds, or by pumping to the Mill 5/6 tailings impoundment. Any accumulation of precipitates on the bottom of these lined ponds would be removed and analyzed for proper disposition. Any hazardous waste found would be disposed of at an appropriate disposal facility and would follow state and federal regulations for handling and disposal. Non-hazardous waste would be placed in the tailings facility high density polyethylene. HDPE liners would be cut up or punctured, folded and covered in place to a minimum depth of 5 feet below the reclamation surface. No sludge or precipitate from pond bottoms would be placed in Newmont's Class III landfill. Pond areas would then be backfilled and the surface graded to establish a reclamation surface

configuration that is compatible with surrounding terrain, and to the extent possible, reestablishes the pre-mining surface of the area. Following grading, the reclamation surface of the pond areas would be prepared and revegetated as described in an earlier section.

The surfaces developed during reclamation would establish drainages and flow paths to facilitate runoff into existing natural drainages located downgradient. All existing natural drainage areas would be utilized, and as necessary, minor reconstruction of these drainages may be performed to control runoff.

Haul Roads

Access road and haul roads exist in the project area. Reclamation activities include the following:

- distributing safety berm material that may contain topsoil on the top of the former roadway;
- grading to approximate pre-disturbance topography;
- ripping/scarifying; and
- revegetating.

The majority of roads are associated with the waste rock disposal areas and heap leach pads and would be reclaimed concurrently with the closure of each individual area. Remaining roads would be reclaimed when they are no longer needed for site access. Remaining portions of haul roads not on the waste rock disposal areas or heap leach pads would be reclaimed by regrading, as necessary to promote drainage and revegetated with techniques described in a preceding section. Regrading would, to the extent practical, reestablish pre-disturbance topography and drainage and provide slopes that would, in conjunction with revegetation, control erosion. One culvert would be constructed in association with this amendment. This culvert would be located at the crossing of the James Creek diversion ditch and the James Creek WRDF haul road, and would be removed upon reclamation. Waterbars would not be installed as part of road reclamation. The reclamation surfaces are designed, in conjunction with revegetation, to minimize surface runoff from the reclamation surfaces and reduce erosion.

The reclamation plan would facilitate natural drainage in the area by directing flow where necessary via drainage ditches, establishing erosion protection where concentrated flow may potentially occur, and restoring and stabilizing surface water drainage. Material will be excavated or regraded as necessary in the drainage areas to facilitate natural drainage and restore free flow. Outlets of drainage ditches would be widened and protected with rock to dissipate energy prior to re-entry into the natural drainage areas.

Ancillary Facilities

Ancillary buildings, and other structures would be dismantled and removed following cessation of operations. Nonsalvageable material (e.g., pond liner, scrap building material, concrete) would be buried on-site or disposed of off-site in compliance with NDEP regulations. Concrete foundations, basements, walls, and sumps would be cracked or broken and buried. Materials that had been in contact with cyanide or other toxic chemicals would be decontaminated prior to disposal. If any materials cannot be rendered non-hazardous, they would be disposed of in appropriate hazardous material disposal facilities.

Disturbed areas would be graded to blend with adjacent topography. Graded surfaces would be spread with 6 inches of topsoil, and ripped to a depth of 12 to 18 inches, where necessary. Seeding, harrowing, and mulching would occur as previously discussed.

Other ancillary facilities including structures, powerlines, and surface pipelines would be removed and lands associated with these facilities would be regraded to contour. Buried pipelines would be plugged and left in place. Some run-on and runoff control ditches would remain as part of the reclamation program to control sediment loss from the site.

Monitoring/Evaluation of Reclamation Success

Qualitative erosion monitoring would be conducted annually to assess effectiveness of erosion control structures, overall stability, and effectiveness of drainage channels. Appropriate measures would be implemented to correct any erosion problems.

Revegetation monitoring would be conducted annually for at least 3 years to assess vegetative cover. Revegetation success would be evaluated based on comparison between the identified and designated "reclaimed desired plant community" and the "reference area." Reference areas would be selected from representative plant communities adjacent to the mine site, test plots, or demonstration areas or, as appropriate, representative ecological range site descriptions. The identified and designated "reclaimed desired plant community" and "reference area" would be selected in consultation with the BLM and NDEP.

Revegetation release criteria for reclaimed mine sites would be to achieve as close to 100 percent of the perennial plant cover of selected comparison areas as possible. Reclaimed areas not meeting these standards would be evaluated and corrective actions implemented. Revegetation success would be determined by comparison with the criteria described in the Nevada Guidelines for Successful Revegetation for the NDEP and BLM.

PROJECT ALTERNATIVES

This section describes alternatives to the Proposed Action including the No Action Alternative, features common to all alternatives, alternatives eliminated from detailed analysis, and the Agency Preferred Alternative. Alternatives selected by BLM for consideration in this EIS are based on potential impacts associated with the Proposed Action and issues, including those identified by the public during the scoping process. The BLM is required to analyze environmental effects resulting from the Proposed Action and to identify reasonable alternatives that would mitigate or eliminate potential impacts. The BLM is also required to analyze the No Action Alternative, which describes the environmental consequences that would result if the proposed project is not implemented.

Newmont's SOAPA involves continuation of existing operations, construction and operation of various new facilities, and expansion of some existing facilities. Components of the planned operations, their respective functions, and potential environmental effects are also considered in delineation of alternatives.

Alternatives Considered in Detail

Features Common to All Action Alternatives

The following components of Newmont's SOAPA are common to all action alternatives considered in detail:

- Continued mining and expansion of the Gold Quarry Mine pit.
- Expansion of the Gold Quarry North, Gold Quarry South, and James Creek WRDFs.
- Expansion of the South Area Leach Facility.
- Expansion of the Refractory Leach Facility.
- Construction of Ancillary Facilities.
- Reclamation of facilities according to BLM and NDEP requirements.

Table 2-10 presents differences among alternatives for specific facilities. **Figure 2-4** illustrates the main differences in the two action alternatives.

Backfilling the waste rock also could serve to reduce the northward and southward expansion and ultimate size of the Gold Quarry North and South WRDFs, respectively. However, the Mac pit would only contain approximately 2 percent of the proposed volume of waste rock to be generated by SOAPA, and the potential reduction in size of the other WRDFs would likely not be noticeable. If the potential reduction in size was in a reduced overall "footprint," it would be approximately 6 acres. If the potential reduction in size resulted in a lower height of a WRDF, it would be approximately 4 to 8 feet. Any reduction in the size of the "footprint" of a WRDF would reduce impacts to existing soils and vegetation. A beneficial effect would result from backfilling the pit by providing an additional 40 acres of grazing land and wildlife habitat following reclamation and revegetation.

Proposed Action with Backfilling of the Mac Pit

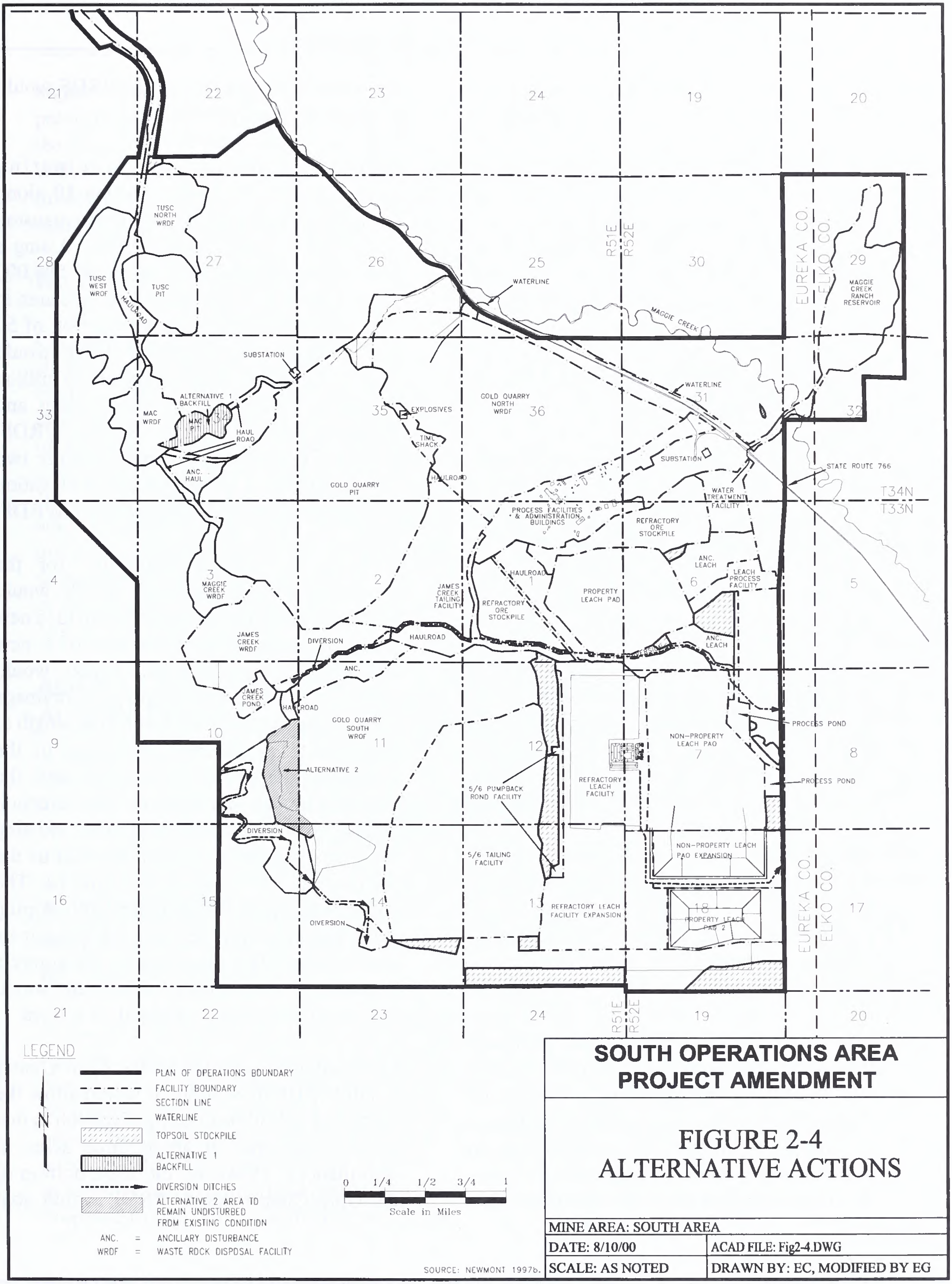
This alternative is essentially the same as the Proposed Action but would place some of the waste rock intended for the WRDFs into the Mac pit. With this alternative, some of the trucks hauling waste rock would exit the Gold Quarry Mine on the west side and would go north along the existing haul road and climb an additional 150 vertical feet (approximately) to reach the elevation of the edge of the Mac pit. It is anticipated that waste rock would be end-dumped from various locations along the south and west sides of the Mac pit. Hauling to the Mac pit would involve a trip with greater vertical distance but less horizontal distance than haulage to the Gold Quarry North and South WRDFs.

Backfilling the waste rock also could serve to reduce the northward and southward expansion and ultimate size of the Gold Quarry North and South WRDFs, respectively. However, the Mac pit would only contain approximately 2 percent of the proposed volume of waste rock to be generated by SOAPA, and the potential reduction in size of the other WRDFs would likely not be noticeable. If the potential reduction in size was in a reduced overall "footprint," it would be approximately 6 acres.

TABLE 2-10
INCREMENTAL SURFACE DISTURBANCE BY ALTERNATIVE

Facility	Proposed Action	Alternative 1 Backfill pit	Alternative 2 Modified WRDFs
Gold Quarry Mine	139	139	139
Tusc Mine	0	0	0
Mac Mine	0	-40	0
Haulage Roads	59	59	59
Dewatering Facilities	-40	-40	-40
Waste Rock Disposal Facilities			
Gold Quarry North WRDF	439	436	439
Gold Quarry South WRDF	235	232	185
Maggie Creek WRDF	-82	-82	-82
James Creek WRDF	255	255	255
Tusc West WRDF	0	0	0
Tusc North WRDF	0	0	0
Mac WRDF	0	0	0
Processing Facilities	0	0	0
Ore Stockpiles	-38	-38	-38
Leaching Facilities			
Gold Quarry Leach Pad	-185	-185	-185
Property Leach Pad	0	0	0
Property Leach Pad 2	163	163	163
Non-Property Leach Pad	182	182	182
Refractory Leach Pad	327	327	327
Tailing Facilities			
James Creek tailing facility	-186	-186	-186
Mill 5/6 tailing facility	0	0	0
Diversion Channels	138	138	135
Topsoil Stockpiles	198	198	198
Ancillary Facilities	-190	-190	-190
Geologic Evaluations	-22	-22	-22
Total Incremental Disturbance of Undisturbed Areas	2,135	2,129	2,082
Total Net Disturbance Acreage	1,392	1,346	1,339

Note: Negative values are derived from existing disturbance that is incorporated into the proposed disturbance, with the exception of the Mac pit in Alternative 1.



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 2-4
ALTERNATIVE ACTIONS

MINE AREA: SOUTH AREA	
DATE: 8/10/00	ACAD FILE: Fig2-4.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY EG

If the potential reduction in size resulted in a lower height of a WRDF, it would be approximately 4 to 8 feet. Any reduction in the size of the "footprint" of a WRDF would reduce impacts to existing soils and vegetation. A beneficial effect would result from backfilling the pit by providing an additional 40 acres of grazing land and wildlife habitat following reclamation and revegetation.

Proposed Action with Modified Waste Rock Disposal Facilities

This alternative is essentially the same as the Proposed Action, but with a different approach for handling waste rock disposal. This alternative was identified to address the issue of the location of waste rock to be placed in WRDFs and their ultimate aesthetic appearance.

The Proposed Action would include hauling waste rock to various locations including road and embankment construction sites within the project area, as well as three designated WRDFs including the Gold Quarry North, James Creek, and Gold Quarry South.

The proposed expansion of the Gold Quarry South WRDF would involve approximately 235 acres to the south and west of the existing Gold Quarry South WRDF. The expansion involves additional haul distances of up to 4,500 feet.

This alternative would substitute some of the horizontal distance to the west (into Section 10) for additional elevation of the Gold Quarry South WRDF in an attempt to have a smaller "footprint" for the Gold Quarry South WRDF and avoid constructing a new diversion channel west of the WRDF. Another lift on the Gold Quarry South WRDF would be about 50 feet in height.

Analysis considered eliminating approximately 50 acres in Section 10 along the western margin of the proposed expansion of the Gold Quarry South WRDF. Using a general volume/capacity figure of 500,000 tons of waste rock per acre of surface area in the proposed WRDFs, the elimination of 50 acres of the Gold Quarry South WRDF would require relocation of approximately 25 million tons into higher lifts on the existing and expanded Gold Quarry South WRDF. Twenty-five million tons might require two additional lifts or about 100 feet of elevation over much of the Gold Quarry South WRDF.

However, a reduced "footprint" for the proposed Gold Quarry South WRDF would not totally eliminate the requirement for a new diversion channel. Construction of a new diversion in the Proposed Action would involve clearing and shaping a drainage channel approximately 8,000 feet in length to intercept three unnamed drainages in the southeast quarter of Section 10 and the northeast quarter of Section 15. The diversion would then intersect with the existing diversion channel at a point just east of the section line between sections 15 and 14. The channel would be flat-bottomed with sloping sides and approximately 25 feet wide at its widest point. This diversion would require a 50-foot wide construction corridor and would disturb an area of approximately 9.2 acres.

Eliminating the portion of the Gold Quarry South WRDF in Section 10 would allow the continued use of the existing diversion in that location (an area of about three acres of disturbance). However, the main portion of the Gold Quarry South WRDF would abut

higher elevation topography and would prevent connection with, and use of, any of the lower portion of the existing diversion without extraordinary construction measures (underground conduits or aboveground siphons).

No Action Alternative

Currently, Newmont has authorization from BLM to operate mining facilities on federal lands in the South Operations Area as provided in the South Operations Area Record of Decision (BLM, 1993) and subsequent approvals. Under the No Action Alternative, BLM would not authorize the SOAPA and additional disturbance of federal land would not occur. Newmont would still be liable for mitigation and monitoring commitments made in the original EIS Mitigation Plan (BLM, 1993).

AGENCY PREFERRED ALTERNATIVE

The Agency Preferred Alternative is the Proposed Action with Backfilling of the Mac pit. This alternative is described previously in this chapter.

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

This section describes alternatives identified through the scoping process that were considered by BLM but dismissed from detailed analysis for various reasons described below. Generally, these alternatives were not technically feasible, economically reasonable, or would not meet the purpose and need of the Proposed Action. These alternatives were first evaluated and eliminated from detailed analysis in the previous EIS (BLM, 1993).

Underground Mining

This alternative would address the issue of surface disturbance impacts, including the areas proposed for the open pit and a portion of the waste rock. Underground mining has higher initial capital and operating costs than open pit mining and typically only becomes practical when extracting deep, high-grade ore. The Gold Quarry Mine expansion primarily is based on low-grade refractory ore, much of which is shallow, therefore, this alternative was eliminated from further consideration because it would be economically prohibitive to extract a large portion of the low-grade mineral reserves.

Water Disposal Alternatives

Four alternatives were evaluated to determine if all the excess water from the dewatering operations could be utilized in a more environmentally effective manner. Of the four disposal alternatives, none could fully demonstrate greater environmental effectiveness than the Proposed Action. Water disposal alternatives were reviewed for their possible effects on four issues: (1) retaining as much water as possible in the Maggie Creek Basin, (2) reducing the degree of impact on riparian habitat, (3) reducing the potential for groundwater loss to communities near the project area, and (4) reducing the area of impact of the groundwater cone of depression. None of the disposal alternatives fully addressed all four criteria, but four alternatives addressed one or more of the criteria and these are summarized below. Details are provided in BLM (1993).

- Reinjection of all excess water into bedrock in Maggie Creek Basin.

  Recycling of injected water into the mine, injection well inefficiencies, potential pit wall instability, and localized groundwater mounding resulting in surface seeps, rendered this alternative technically infeasible, and it was, therefore, eliminated from detailed analysis.

- Infiltration of all excess water into the shallow alluvial system in Maggie Creek Basin.

  This alternative was eliminated from detailed analysis because the Maggie Creek basin has inadequate capacity for disposal of a significant amount of excess water.

- Use of excess waters to irrigate lands in Maggie Creek Basin.

  Newmont currently irrigates in the lower Maggie Creek Basin and has evaluated potential irrigable lands in the upper Maggie Creek Basin. Total potential irrigation in the Maggie Creek Basin available to Newmont was significantly less than the volumes produced each year, thus eliminating this alternative from detailed analysis.

- Construction of East Cottonwood Creek Reservoir.

  This alternative was eliminated from detailed analysis because of its inability (even in combination with Maggie Creek Ranch Reservoir) to contain a significant portion of the excess water generated by the Gold Quarry project.

Backfilling the Tusc Pit

Backfilling the Tusc pit with Gold Quarry waste rock would require the longest haul of all possible locations in the South Operations Area and would also be the haul route with the greatest vertical climb. This would result in the most vehicle and fuel usage of all alternatives, and thus eliminated the alternative from detailed analysis.

Backfilling the Gold Quarry Pit

Backfilling the Gold Quarry pit would require rehandling of waste rock previously placed in waste rock disposal facilities because it is the last pit scheduled for completion. This would result in a significant increase in project duration and, therefore, fuel usage. The time extension and fuel costs eliminated this alternative from detailed analysis.

CHAPTER 3
AFFECTED ENVIRONMENT FOR PROPOSED ACTION AND ALTERNATIVES

CHAPTER 3

AFFECTED ENVIRONMENT FOR PROPOSED ACTION AND ALTERNATIVES

Studies have been conducted to characterize environmental resources in the proposed SOAPA area. The studies were designed to compare conditions in 1999 with those reported in 1993 in the previous EIS (BLM, 1993).

This chapter summarizes environmental baseline information for both the Proposed Action and other alternatives. For several environmental disciplines, this chapter refers the reader to the original EIS (BLM, 1993) for further baseline description of the resources. Within the following discussion, several area terms are used and their definitions are:

- Amendment area - the parcels of land comprising 1,392 acres which are proposed to be added to the South Operations Area, and in which expansion of facilities is proposed.

- Mine area or Disturbance area - areas within the project area where actual facilities are located or proposed.

- Project area - The area comprising Newmont's South Operations Area, encompassed by the perimeter fence.

- Study area - each environmental discipline defined its own study area. For example: soils were surveyed on the amendment area; socioeconomics were evaluated for Elko and Eureka counties; cultural resources were surveyed in a 9,352-acre disturbance area in several studies during the life of the project.

CRITICAL ELEMENTS OF THE HUMAN ENVIRONMENT

Of the 14 critical elements of the human environment which must be considered in environmental documents, all but four will be discussed in this document: (1) no areas of critical environmental concern are near enough to the SOAPA area that they would be affected; (2) no prime or unique farmlands are present in the study area; (3) no wild and scenic rivers are present in the study area; and (4) no wilderness areas are close enough to be affected. The Ruby Mountain and Jarbidge Wilderness areas are 40 and 55 miles distant, respectively. Of the ten wilderness study areas on lands near SOAPA, the nearest, Red Spring and Cedar Ridge, are 25 miles to the southeast.

GEOLOGY AND MINERALS

Geologic Setting

The project area is located within the Basin and Range physiographic province, a semi-arid region stretching from southeastern Oregon to Arizona. In Nevada, this province is characterized by roughly parallel fault-block mountain ranges which generally trend north-south. The ranges are separated by nearly level desert basins filled with alluvium derived from the adjoining mountains. The project area itself is located within the Maggie Creek valley and on the lower eastern slopes of the north-south trending Tuscarora Mountains.

The study area comprises the Carlin Trend, a 50-mile long feature characterized by gold deposits in sedimentary rock extending southeast-northwest through the Tuscarora Mountains. It stretches from the Rain Mine (approximately 10 miles southeast of the town of Carlin) to the Hollister Mine, approximately 40 miles to the northwest. Within the project area, the gold deposits are found in a window of Paleozoic rock, including the Roberts Mountains Formation. This window is surrounded by younger Cenozoic-era sedimentary bedrock of the Carlin Formation (Roberts, Montgomery, and Lehner, 1967). Throughout most of the project area, bedrock is mantled by unconsolidated Quaternary alluvial, colluvial, conglomerate, and landslide deposits (Knight Piesold, 1990). The geology of the area is described and illustrated in BLM (1993).

A generalized characterization of waste rock to be removed from the Gold Quarry pit is derived from the characterization of the ultimate pit surface presented in Geomega (1997b). The pit surface was simulated to consist of six units characterized by their net carbonate value, a measure of acid generation or acid neutralization potential, if negative or positive, respectively. The six units are: (1) alluvium in the Tertiary Carlin Formation, a weakly cemented, fine-grained material. The net carbonate values of this unit are generally slightly positive (+0.47) because the alluvium contains very little sulfide or carbonate; (2) carbonaceous silicious refractory rock in the Rodeo Creek siltstone. The net carbonate values of this unit are generally negative to zero because this rockcontains both sulfide and carbonate minerals and ranges from -2.19 to +0.66; (3) sulfidic, silicious refractory rock in the Rodeo Creek siltstone characterized by dark siltstone with visible pyrite grains. The net carbonate values of this unit are predominantly negative because of the greater than 2 percent sulfide content, ranging from -2.74 to +6.60; (4) oxidized silicious rock contained in the Rodeo Creek siltstone is a tan siltstone, with net carbonate values ranging from -1.29 to +0.66 because of low sulfide and carbonate contents; (5) oxidized calcareous rock in the Popovich limestone is a light-colored limestone with net carbonate values greater than +7; and (6) unoxidized calcareous rock in the Popovich limestone is a dark-colored limestone with net carbonate values greater than +15.

Geologic Hazards

The potential for development of sinkholes or similar collapse features that could result from mine induced drawdown and water management activities has been identified as a significant issue for the assessment of cumulative impacts to geology and minerals within the project area (BLM, 2000b). These features form with the dissolution of calcium carbonate in limestone and dolomite. Lowering the water table can increase vertical seepage rates and cause collapse of near surface caverns which are buoyed by the water table. The solution process may be accelerated somewhat by these artificial changes in groundwater conditions such as higher velocity water movement through geologic materials susceptible to dissolution.

Draining of water from caverns and other void spaces may also cause collapse of unconsolidated sediments overlying them.

The Roberts Mountains Formation comprising the gold-bearing window within the project area is comprised primarily of limestone and dolomitic limestone (Rota, 1991) which are susceptible to calcium carbonate dissolution. In fact, a sinkhole was

discovered in July 1996 in the Maggie Creek Canyon just north of the project area. The development of this feature was likely related to dewatering of the Gold Quarry pit which had lowered the water table 350 feet in the pit area (BLM, 2000a). **Figure 3-0** shows areas potentially susceptible to sinkhole development in the SOAPA area.

The site-specific risk of sinkhole development in this region will depend on both natural site conditions and hydrologic changes induced by mine dewatering and water management activities.

The project area is located in the Great Basin seismic zone. This area, characterized by northerly trending mountain ranges bounded by faults, experiences moderately high rates of seismic activity. A search of recorded earthquakes within 44 miles of the site revealed 10 events with magnitudes between 3.6 and 5.1 on the Richter Scale for the period 1901 through 1979 (Slemmons, 1983). For the period 1980 through August 31, 1997, there were two events with magnitudes of 4.4 and 4.9 (USGS, 1997).

Active fault systems, those with evidence of movement within the past 12,000 years, have been recognized to the west and south of the site. No active faults have been identified in the project area. **Table 3-1** presents the seismic characterization for the project area.

Newmont (1996) reviewed the long-term, post-reclamation seismic stability of site facilities using a seismic coefficient of 0.15g (15 percent of the acceleration of gravity). The analysis found the seismic stability of facilities to meet or exceed an acceptable factor-of-safety of 1.0.

Analyses in the previous EIS (BLM, 1993) indicated that liquefaction and surface rupture were considered unlikely and very low, respectively. All facilities, including waste rock disposal facilities and leach pads, and the earthen embankment between the pit boundary and the James Creek tailing facility are designed to withstand the maximum horizontal acceleration from seismic events as described in **Table 3-1**.

Mineral Resources

Gold mining has been the primary mineral resource recovery activity in the project area. Anticipated production for the South Operations Area was presented in Chapter 2. A complete description of mineral resources is presented in the previous EIS (BLM, 1993).

Acid Rock Drainage

The South Operations Area Project has experienced no known incidence of acid rock drainage to the environment to date. Development of refractory (sulfide) ore deposits at the South Operations Area has increased the amount of potentially acid-producing material stored in stockpiles and deposited in waste rock dump facilities. This provides a greater potential source of acid rock drainage than has existed in the past.

Minor acid rock drainage currently occurs at the Refractory Ore Stockpile adjacent to the Property Leach Pad. This drainage only occurs seasonally, is not measured by Newmont, but is captured and used in ore processing.

Newmont samples, tests, and classifies the waste rock, in accordance with the NDEP Waste Rock and Overburden Evaluation guideline (NDEP, 1996), to determine the potential of the mined waste rock to generate

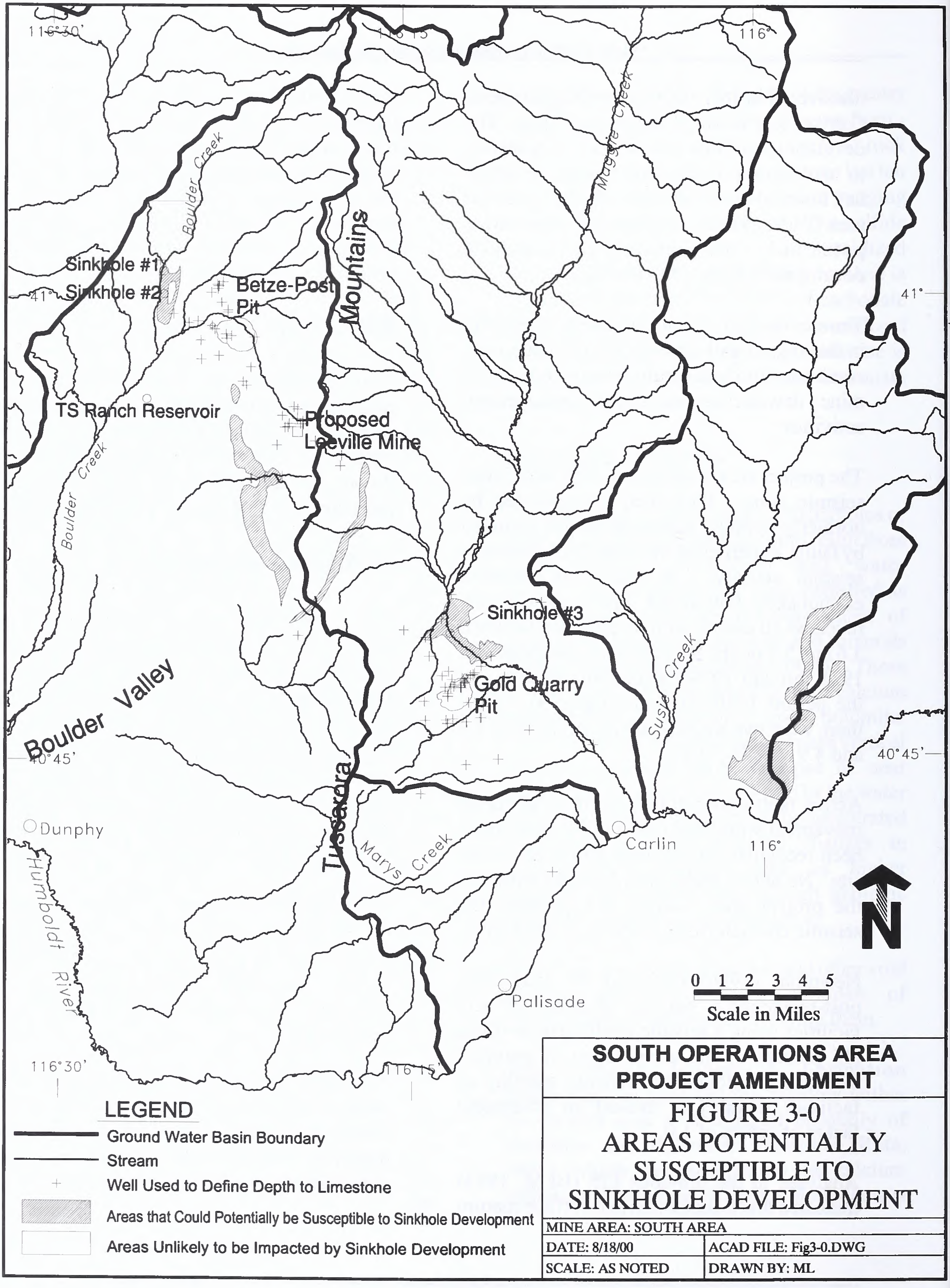

116°30'
116°15'
116°
41°
40°45'
Sinkhole #1
Sinkhole #2
Betze-Post Pit
Boulder Creek
Maggie Creek
Mountains
TS Ranch Reservoir
Proposed Leeville Mine
Sinkhole #3
Gold Quarry Pit
Susie Creek
Boulder Valley
Tuscarora
Marys Creek
Dunphy
Humboldt River
Carlin
Palisade
N
0 1 2 3 4 5
Scale in Miles
LEGEND
Ground Water Basin Boundary
Stream
Well Used to Define Depth to Limestone
Areas that Could Potentially be Susceptible to Sinkhole Development
Areas Unlikely to be Impacted by Sinkhole Development
SOUTH OPERATIONS AREA PROJECT AMENDMENT
FIGURE 3-0
AREAS POTENTIALLY SUSCEPTIBLE TO SINKHOLE DEVELOPMENT
MINE AREA: SOUTH AREA
DATE: 8/18/00
ACAD FILE: Fig3-0.DWG
SCALE: AS NOTED
DRAWN BY: ML

TABLE 3-1
SEISMIC CHARACTERIZATION FOR THE SOAPA

Assessment Method	Maximum Earthquake Magnitude (M)	Maximum Horizontal Acceleration (g)	Probability of Occurrence
Maximum Credible Earthquake from Active Fault (Slemmons, 1983)	7.2	0.42	Not applicable
Regional Probabilistic Assessment (Algermissen et al., 1982, 1990)	7.3	0.15	90% probability of not being exceeded in 50 years
	7.3	0.30	90% probability risk of not being exceeded in 250 years

acid. Potentially acid generating waste rock that is identified would be segregated, encapsulated, and monitored in accordance with Newmont's Refractory Stockpile and Waste Rock Dump Design, Construction, and Monitoring Plan (Newmont, 1997d). The agency guidelines were developed to manage potential acid rock drainage through control of the acid generation process.

Newmont has developed an extensive program designed to identify sources of potentially acid generating rock before they are removed during mining operations. This allows the planned mining of the rock and its placement in refractory rock-specific stockpiles and disposal areas that are designed to prevent vertical migration of water and to contain lateral surface flows from the waste rock dump facilities. Seven steps are followed to ensure control of any acid rock drainage: (1) segregation and placement of sulfidic wastes in internal areas of waste dumps above a prepared base; (2) total enclosure or encapsulation of the sulfidic waste zone with non-acid producing material; (3) careful sloping and random wheel compaction of individual lift surfaces; (4) control of surface water flows to prevent infiltration; (5) monitoring all ditches and berms on a quarterly basis and whenever flood conditions exist or have occurred (Newmont, 1997b); (6) placement of a low permeability cap over the final encapsulation cell; and (7) reclamation of the waste rock disposal facility, including establishing vegetation, to minimize water infiltration.

PALEONTOLOGICAL RESOURCES

Paleontological resources in the project area could include vertebrate, invertebrate, and paleobotanical fossils. Known vertebrate fossils typically are associated with Tertiary sediments, but also occur in younger Quaternary sediments. All known fossils in the project area have a relatively broad regional distribution, and are not restricted to the area of north-central Nevada.

The majority of paleontological resources identified to date on public lands in the Elko area are invertebrate fossils and have been

assigned the lowest (S-3) significance ratio by Firby and Schorn (1983). Other fossils not reported in the project area, but known from geological formations that occur in the project area include Paleozoic graptolites, conodonts, brachiopods, corals, crinoids, and fishes, and Quaternary equids, camelids, and proboscids.

Previous paleontological inventory along James Creek (Clerico, 1983) reported horse, camel, and possibly lagomorph (rabbit or hare) bones exposed in and redeposited from Miocene sediments of the middle member of the Humboldt Formation (Firby, 1990). The middle member of the Humboldt Formation is also referred to as the Carlin Formation (Regnier, 1960). The outcrops containing the fossils consisted of tufaceous sandstones and silty mudstone. The upper member of the Humboldt Formation, which occurs sporadically in the project area, does not contain mammalian vertebrate fossils. In other areas of Nevada, the middle Miocene to early Pliocene Carlin Formation has yielded horse, camel, and elephant fossils, but surface evidence in the project area of such finds is sparse and does not suggest a potential for significant localities. Horse and camel fossils have also been reported from Quaternary deposits elsewhere in Nevada, but only scattered specimens from unconsolidated deposits have been reported in the general project area. The Ordovician age Vinini Formation, which has been identified at a few locations along James Creek, contains graptolite and conodont fossils at some localities, but these fossils are not generally considered significant.

During the recent archaeological inventory in the amendment area (Newsome and Tipps, 1997), archaeologists also noted locations of paleontological specimens. Previously unsurveyed and undisturbed portions of the project area were surveyed by pedestrian transect intervals of 30 meters or less for paleontological resources. A single camel foot bone was discovered in redeposited materials along Maggie Creek (Newsome and Tipps, 1997). This specimen was not considered to be a significant find.

AIR RESOURCES

Climate

The South Operations Area is located in the Maggie Creek basin airshed, a north-south valley bounded on the west by the Tuscarora Range and on the east by the Independence Mountains. The study area for SOAPA is the airshed basin. The project area is located on generally rolling terrain at elevations of 5,170 to 5,680 feet above mean sea level. The climate is classified as mid-latitude steppe, which experiences large daily temperature range, low precipitation and relative humidity, high evaporation, and limited cloud cover.

Climatic conditions such as wind speed, wind direction, precipitation, and temperature are monitored at Newmont's meteorological station. Site data have been collected since approximately 1989, however, the duration of data collection is not appropriate for accurate long-term statistical analysis. Therefore, off-site data have been used to provide more statistically reliable data.

Annual precipitation does not occur uniformly throughout the year. Generally more than half of the precipitation occurs during the five month period from October to February, primarily as winter snowfall. Most of the precipitation at the mine area occurs at high intensity, low duration thunderstorm events, or as winter snowfall. Precipitation is greater

at higher elevations and snow can accumulate to considerable depths.

Precipitation in Nevada is highly dependent on altitude. Plume (1994) analyzed data for 14 stations to develop a relation between precipitation and altitude for northeastern Nevada. A linear regression resulted in the following equation: mean annual precipitation equals 0.00356 times altitude minus 8.56. This results in mean annual precipitation of 9.8 to 11.7 inches for the Gold Quarry project area for the elevations from 5,170 to 5,680 feet above mean sea level. A similar approach was followed by HCI (1999) for data from nine stations around the mine area. The HCI regression resulted in a mean annual precipitation of approximately 9.5 inches per year for the project area. Precipitation at the mine site in 1989 and 1990 averaged 7 and 7.8 inches, respectively, during a what was considered a period of drought lasting from 1989 through 1996. In 1998, precipitation was much higher than normal. The average precipitation for the years 1996 through 1999 was 11.6 inches.

The precipitation records for Elko (5,080 feet elevation), Beowawe (4,700 feet elevation) and Beowawe U of N Ranch (5,740 feet elevation) were compared for their period of record determine the mean monthly precipitation for the project site **(Table 3-2)**. The precipitation at the mine site was estimated roughly to increase by 0.3 inch per month for December through May over precipitation at the Elko site, and be roughly the same for the month of June through November. Temperatures in the mine area have wide daily and seasonal variability, with daily fluctuations of 30° to 40° F common, due to high elevation, proximity to mountains, and limited cloud cover. Temperatures are warmest in July and August, and coldest in January and February **(Table 3-2)**.

Figure 3-1 shows the distribution of wind velocity from data measured at the South Operation Area. The predominant wind direction is from the west-northwest throughout the year. When large-scale atmospheric pressure patterns are weak, local wind flow is affected by the heating and cooling of the Tuscarora Range. Cooler mountain air flows downslope (from the west) at night. Conversely, warmer valley air flows upslope (from the east) during the day until afternoon ground heating causes instability that results in variable wind direction and speed.

Air Quality

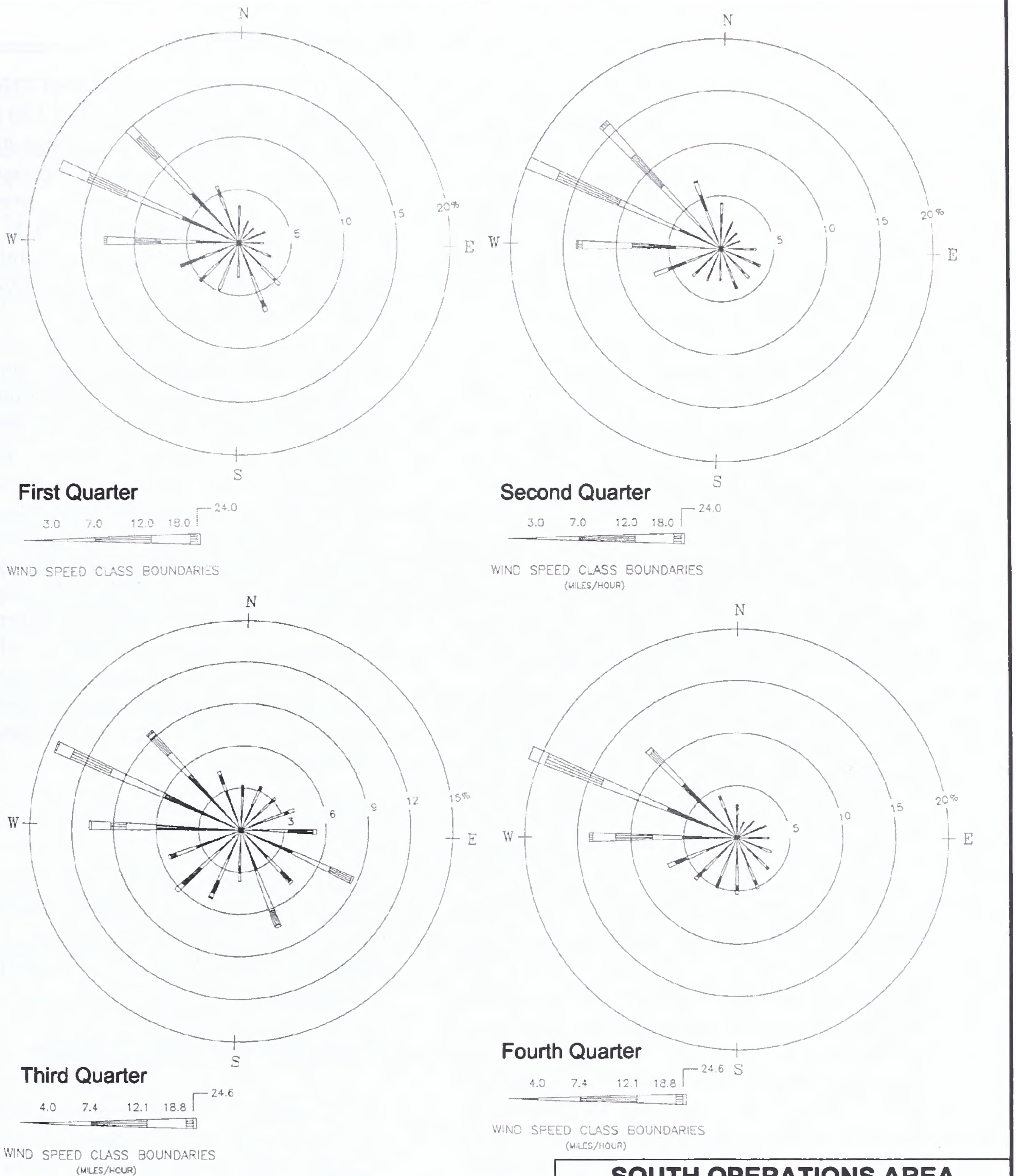
The South Operations Area is located in Maggie Creek hydrographic basin (51). Air Quality in the project area is generally good. The area is designated as unclassifiable status (ambient levels below statutory limits) for all applicable criteria pollutants (nitrogen oxides, sulfur dioxide, carbon monoxide, and particulates (PM_{10}), with an aerodynamic diameter of less than 10 microns. Monitoring is not required for lead or ozone.

Ambient PM_{10} measurements have been recorded at the South Operations Area since 1992. No ambient measurements have been taken for the other criteria pollutants. The PM_{10} measurements have clearly demonstrated that the current mining operations are not contributing to any violations of the State of Nevada or National Ambient Air Quality Standards (NAAQS).

The NAAQS for PM_{10} are 150 micrograms per cubic meter ($\mu g/m^3$) for a 24-hour period and 50 $\mu g/m^3$ for the annual arithmetic average. The Federal NAAQS allow one exceedance annually for the 24-hour standard. The State of Nevada does not allow any exceedances. Therefore, the South Operations Area operates

Table 3-2
SOAPA CLIMATOLOGY

Station	Elevation feet amsl	Period of Record		Jan.	Feb.	Mar	April	May	June	July	Aug	Sept.	Oct.	Nov.	Dec.	Annual
								Mean Monthly Precipitation (inches)								
SOAPA	5,300	1989		0.47	0.38	1.82	0.20	0.15	0.53	0.49	0.22	0.66	0.90	0.74	0.43	6.99
SOAPA	5,300	1990		0.50	0.29	0.47	1.69	1.02	1.10	0.23	1.23	0.17	0.12	0.62	0.35	7.79
SOAPA	5,300	1996-1999		2.32	1.08	0.76	1.16	1.52	0.90	0.33	0.24	0.65	0.66	0.85	1.14	11.61
Elko	5,080	1928-1998		1.16	0.82	0.90	0.80	1.02	0.80	0.36	0.44	0.50	0.70	0.99	1.03	9.52
Beowawe	4,700	1949-1998		0.79	0.62	0.75	0.81	1.19	0.90	0.29	0.44	0.51	0.61	0.82	0.82	8.77
Beowawe U of N Ranch	5,740	1972-1998		1.04	0.77	1.35	1.11	1.38	0.85	0.52	0.57	0.85	0.92	1.02	0.83	10.97
								Temperature (F)								
SOAPA	5,300	1989	Mean	28	27	40	50	52	65	74	70	70	50	35	17	48
SOAPA	5,300	1990	Mean	21	29	41	50	54	63	77	69	60	47	35	29	48
Elko	5,080	1928-1998	Average Max	36.2	41.8	50.0	59.5	69.0	79.1	90.4	88.5	78.8	65.6	49.0	38.3	62.3
			Average Min	11.8	17.7	23.8	29.0	36.0	42.6	48.9	46.5	37.3	28.3	20.2	13.7	29.7
Beowawe	4,700	1949-1998	Average Max	40.1	46.3	53.6	62.4	72.0	81.8	91.6	89.7	80.5	67.8	51.5	41.1	65.0
			Average Min	14.6	20.6	24.9	29.4	37.0	43.9	49.7	47.2	38.5	28.7	21.5	15.2	30.9
Beowawe U of N Ranch	5,740	1972-1998	Average Max	40.0	45.8	51.2	58.9	68.1	78.4	87.3	85.9	77.6	66.0	51.0	41.9	62.8
			Average Min	13.3	19.6	25.7	29.8	36.3	43.2	49.1	47.0	39.1	29.3	21.4	14.5	30.7



Explanation: Diagram of frequency of occurrence (%) for each wind direction. Wind direction is the direction from which the wind is blowing. Example in third quarter- Wind is blowing from the North 3.2 percent of the time.

SOUTH OPERATIONS AREA PROJECT AMENDMENT	
FIGURE 3-1 1998 QUARTERLY WIND ROSES	
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SCALE: NTS	DRAWN BY: EC, MODIFIED BY DS

under the more stringent Nevada standard. As shown on **Table 3-3**, the highest annual average was 27 $\mu g/m^3$ in 1994, and the highest 24-hour concentration was 133 $\mu g/m^3$ in 1994. Both the 24-hour maximum and the annual average in 1994 reflect the extra fugitive dust caused by construction activities. Nevertheless, these values are within the limits of the NAAQS.

Regulatory Status

The South Operations Area Project is considered a major source under the Prevention of Significant Deterioration criteria because the facility has the potential to produce emissions of at least one criteria pollutant in excess of 250 tpy.

Stationary point sources on the mine site, including Mills 5 and 6 and the South Area Leach ore crushing and material handling systems, have the potential to emit 450 tpy of PM_{10}. Gaseous emissions are approximately 260 tpy of nitrogen oxides, 220 tpy of sulfur dioxide, 120 tpy of carbon monoxide, and 40 tpy of volatile organic compounds.

Newmont has an air quality permit from the NDEP, Bureau of Air Quality, to operate all elements of the existing operation.

As part of its application for an air quality permit, Newmont completed air dispersion modeling to estimate the ambient air concentrations of criteria pollutants resulting from milling and leaching operations to include mills, kilns, crushers, boilers, and dryers. The modeling used meteorological data collected on site. Based upon the modeled results, the maximum PM_{10} ambient air concentrations outside of the permit boundary would be 59.3 $\mu g/m^3$ for a 24-hour period and 6.2 $\mu g/m^3$ for the annual average. The 24-hour maximum is 39 percent of the State of Nevada and Federal National Ambient Air Quality Standard of 150 $\mu g/m^3$, and 12 percent of the annual average standard of 50 $\mu g/m^3$. The results of the modeling (**Table 3-4**) showed that predicted concentrations of nitrogen oxides, sulfur dioxide and carbon monoxide would range from 2.7 to 9.4 percent of the NAAQS for all applicable averaging times.

PM_{10} in the form of fugitive dust is generated by mining activities such as drilling and blasting, loading of waste rock and ore, haul trucks transporting waste rock to disposal areas and ore to processing facilities, and wind-blown erosion on exposed areas. These fugitive dust emissions are reduced by Newmont's application of Best Management Practices (Handbook of Best Management Practices, Nevada State Conservation Commission, 1994). Examples of these practices include direct water application, the use of chemical binders or wetting agents, and revegetation of disturbed areas concurrent with operations.

WATER RESOURCES

The discussion of existing water resources is divided into two sections describing the surface and groundwater systems. Each section includes a discussion of water quantity and quality.

Surface Water Hydrology

The South Operations Area Project lies within the Humboldt River Basin in northern Nevada. The Humboldt River Basin has an area of approximately 17,000 square miles and elevations range from 3,900 to 11,800 feet above mean sea level. Headwaters of the Humboldt River are located in the northeast corner of the state. The river flows westward to the Humboldt and Carson sinks located in

TABLE 3-3
PM_{10} MEASUREMENTS IN THE PROJECT AREA

Year	1992	1993	1994	1995	1996
24-Hour Maximum	90	55	133	43	83
% of NAAQS	60	37	89	29	55
Date of Maximum	Sept. 21	Nov. 9	June 13	Aug. 7	August 13
Annual Average	22	19	27	17	23
% of NAAQS	44	38	54	34	46

Source: McVehil-Monnett Associates, Gold Quarry PM_{10} Monitoring Consultants.

TABLE 3-4
PREDICTED AMBIENT AIR CONCENTRATIONS OF CRITERIA POLLUTANTS ASSOCIATED WITH ORE PROCESSING

Pollutant	NAAQS ($\mu g/m^3$)	Averaging Time	Predicted Concentration ($\mu g/m^3$)	Percentage of NAAQS (%)
PM_{10}[1]	50	Annual	6.15	12.3
	150	24 Hours	59.29	39.5
Carbon Monoxide[2]	10000	8 Hours	272.22	2.7
	40000	1 Hour	1097.81	2.7
Nitrogen Oxide[3]	100	Annual	3.50	3.5
Sulfur Dioxide[3]	80	Annual	2.95	3.7
	365	24 Hours	29.58	8.1
	1300	3 Hours	122.09	9.4

Source:
[1]Trinity Consultants, Inc., 1997.
[2]Trinity Consultants, Inc., 1998.
[3]Trinity Consultants, Inc., 1996.

west-central Nevada, where flow ceases due to seepage and evapotranspiration (Eakin and Lamke, 1966). Rye Patch Reservoir is a major surface water body located on the Humboldt River approximately 130 miles downstream of the town of Carlin. This reservoir has a capacity of 194,300 acre-feet and is used for recreation, fishing, boating, and irrigation in the Lovelock area.

Other major tributaries in the study area include Susie Creek, Marys Creek, and

Boulder Creek. Susie and Marys creeks flow south and discharge to the Humboldt River upstream and downstream, respectively, of the Maggie Creek confluence. Boulder Creek drains southwest to its confluence with the Humboldt River east of the town of Battle Mountain.

The South Operations Area Project is located completely within the Maggie Creek drainage basin, but the study area includes adjacent basins. The headwaters of Maggie Creek are in the Independence Mountains located north of the town of Carlin. Maggie Creek flows south to its confluence with the Humboldt River east of the town of Carlin. Important tributaries to Maggie Creek in the study area (listed going upstream) include James, Soap, Simon (with tributary Lynn Creek), East Cottonwood, Jack, Little Jack, Coyote, Spring, Fish, Haskell, and Beaver creeks.

Streamflow in northern Nevada varies seasonally, with high flows typically occurring from March through June, and low flows from August through February. Some drainages or portions of drainages are ephemeral (become dry) during low-flow periods, and some are intermittent (having subsurface flows with intermittent surface flow), flowing only seasonally and in response to precipitation and/or snowmelt events. Surface water basins and monitoring station locations are shown in **Figure 3-2**.

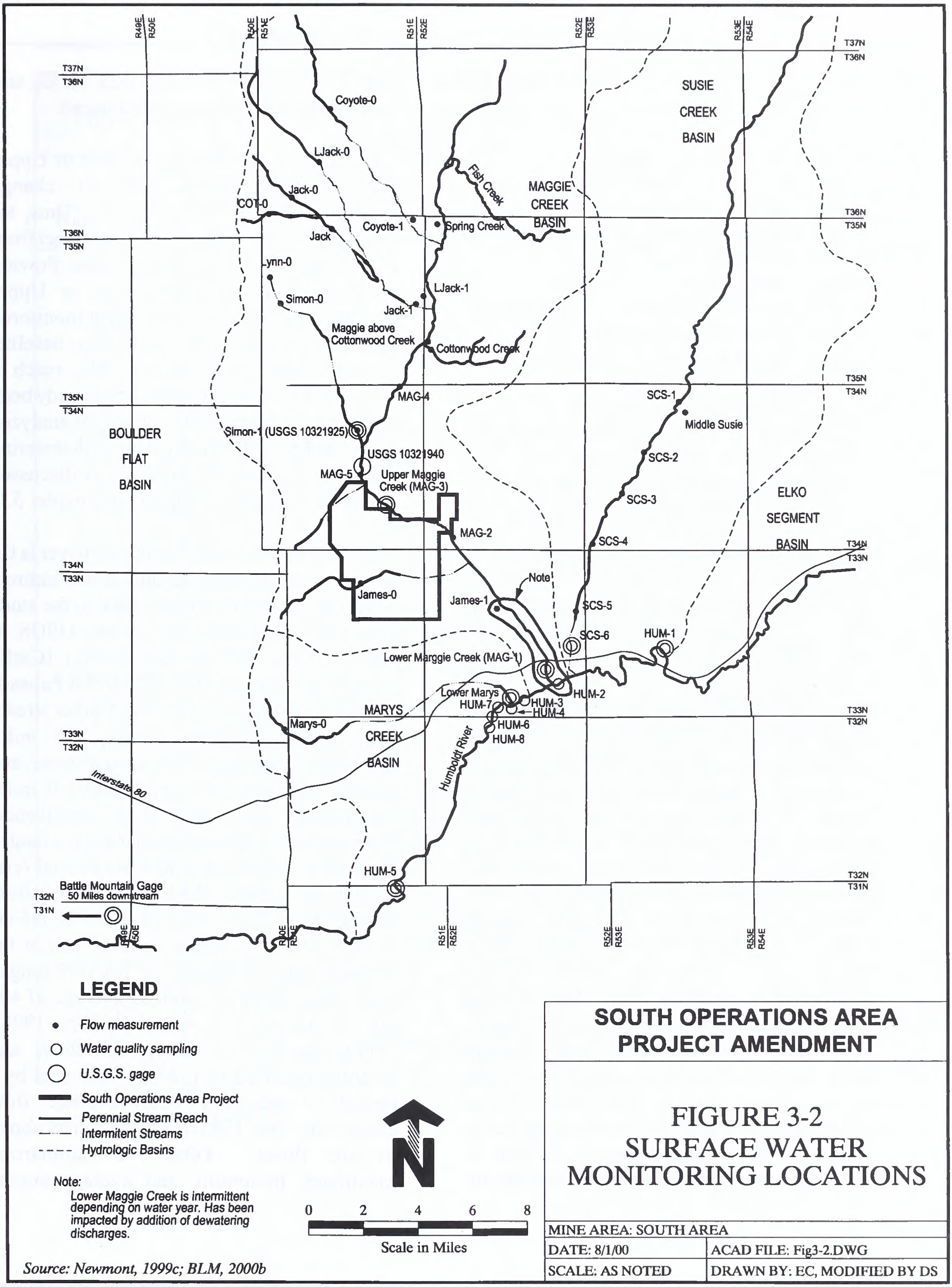
Springs function as a connection between the groundwater and surface water hydrologic systems and provide baseflow to area drainages. Baseflow is defined as the direct groundwater contribution to streamflow. Baseflow is observed during the late fall and early winter period when agricultural diversions and evapotranspiration are minimized and groundwater contributions to streamflow are not influenced by seasonal runoff. Baseflow measurements in northern Nevada are typically recorded during the month of October. The combination of infiltration, and agricultural and domestic diversions are highest for most streams in the study area in March through May. However, Maggie Creek typically peaks in March.

In the SOAPA area, precipitation, which averages 11.6 inches annually measured at Gold Quarry **(Table 3-2)**, supplies groundwater recharge and surface water to the Humboldt River Basin. Annual snowpack averages 55 inches in the mountain areas. There is no outflow from the closed Humboldt basin except through evapotranspiration. Maximum free surface evaporation is about 44 inches per year (Stone and Leeds, 1991). Approximately 85 percent of total precipitation is lost through evapotranspiration, and the remaining 15 percent is divided equally between surface runoff and groundwater recharge (Stone and Leeds, 1991). In the Maggie Creek Basin, average recharge to groundwater from precipitation amounts to approximately 23,000 acre-feet per year (Maurer, Plume, Thomas, and Johnson, 1996).

Surface Water Quantity

The U. S. Geological Survey (USGS) maintains eight surface water stations in the area including:

- two stations on the Humboldt River USGS 1032100 and 10322500;
- three stations on Maggie Creek, USGS 10321940, 10321950, and 10322000;
- one station on Marys Creek near its confluence with the Humboldt River, USGS 10322150;
- one station on Susie Creek near the Humboldt River (USGS 10321590); and
- one station on Simon Creek near its confluence with Maggie Creek (USGS 10321925).



Source: Newmont, 1999c; BLM, 2000b

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-2
SURFACE WATER MONITORING LOCATIONS

MINE AREA: SOUTH AREA	
DATE: 8/1/00	ACAD FILE: Fig3-2.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY DS

Newmont collects flow measurements at 27 additional sites including:

- five stations on Susie Creek;
- two stations on Simon Creek;
- four stations on Maggie Creek;
- one station on upper Marys Creek;
- two stations on James Creek;
- one station on upper Lynn Creek;
- one station on Cottonwood Creek near its confluence with Maggie Creek;
- three stations on Jack Creek;
- two stations on Little Jack Creek;
- two stations on Coyote Creek;
- one station on Spring Creek near the confluence with Maggie Creek;
- two stations on Welches Creek; and
- one station on Mack Creek.

Figure 3-2 shows the locations of the regional surface water monitoring stations. Hydrographs for these sites are presented in the Maggie Creek Basin Monitoring Plan (Newmont, 1999c).

Perennial Reaches in Upper Maggie Creek Basin. Perennial fall flows (or base flows) in stream reaches are supported by discharge from either the regional groundwater aquifer system or from more isolated or perched aquifers residing above the regional groundwater system or they lose water to the local water table. Flowing reaches have been monitored by Newmont in upper Maggie Creek Basin every September from 1994 through 1997 (Newmont, 1997a, 1999c). Monitored voluntarily were the flowing reaches of Jack, Simon, and part of Maggie creeks as well as reaches in Coyote, Spring, Little Jack, Indian, Cottonwood, and Lynn creeks. More streams were monitored in September 1997 than in the preceding years. In addition to the above streams, streams in the Susie Creek Basin, Boulder Flat Basin, Rock Creek Valley, Willow Creek Valley, and Independence Valley were monitored.

The extent of the flowing reaches in Upper Maggie Creek Basin did not change significantly from 1994 to 1997. Thus, to-date, there has been no noticeable impact from Gold Quarry dewatering on the flowing reaches. The flowing reaches in Upper Maggie Creek Basin, voluntarily monitored by Newmont in 1997, represent baseline perennial reaches for this EIS. The reach in Maggie Creek Canyon may have already been impacted by Newmont dewatering as analyzed by the BLM (1993) and by Barrick dewatering (possibly in Boulder Flat area) as discussed under the cumulative impacts in Chapter 5.

Humboldt River. The Humboldt River is the longest river in Nevada and flows entirely within the state. The river's flow in the study area has been measured by the USGS at surface water stations near Carlin (Carlin Tunnels stream gage, HUM 1) and at Palisade (HUM 5) (**Figure 3-2**). The Carlin stream gage is located approximately 5.5 miles upstream of the Maggie Creek confluence, and the Palisade gage is approximately 9 miles downstream of Maggie Creek confluence. Average annual flow at the Carlin gage ranged from 64 to 1,730 cubic feet per second (cfs) during the period 1944-98; the long-term average flow for 55 years of record is 385 cfs (USGS, 1998). Average annual flow at the Palisade gage for the period 1903-98 ranged from 35 to 1,846 cfs, with an average of 403 cfs for 96 years of record (USGS, 1998). Within the last 16 years, high flows and flooding occurred in 1983-84, followed by a period of generally below-average flow conditions, and 1995-1998 have had above average flows. **Table 3-5** summarizes maximum, minimum, and average annual

TABLE 3-5
HUMBOLDT RIVER FLOWS AT CARLIN TUNNELS AND PALISADE GAGING STATIONS FOR 1983-1998

Water Year (Oct-Sept)	Maximum Flow (highest daily mean)		Minimum Flow (lowest daily mean)		Average Annual Flow (cfs)
	cfs[1]	Month	cfs	Month	
Carlin Tunnels Gage					
1983	6830	March	71	September	1038
1984	8090	May	135	September	1730
1985	1490	April	10	August	871
1986	5300	February	13	September	618
1987	748	May	1.2	September	150
1988	833	June	3.5	October	136
1989	1630	March	5.4	August	312
1990	1020	June	7.2	September	148
1991	1190	June	8.2	October	136
1992	314	March	4.3	July	76
1993	2890	March	12	October	396
1994	1050	May	6.6	September	128
1995	6370	June	12	October	593
1996	2580	May	16	August	495
1997	3360	June	21	October	607
1998	3270	June	48	August	641
Palisade Gage					
1983	6380	March	63	September	1261
1984	7820	May	177	September	1846
1985	1830	April	26	August	427
1986	5980	February	23	September	729
1987	768	May	13	September	172
1988	847	June	12	September	149
1989	2260	March	9.1	August	369
1990	1080	June	15	September	166
1991	1090	June	17	October	144
1992	353	March	12	July	88.5
1993	3650	March	21	December	457
1994	971	May	21	July	145
1995	5730	June	31	October	628
1996	2620	May	41	September	577
1997	3360	June	41	October	712
1998	3280	June	78	October	733

Source: USGS, 1983-1999.
[1] cfs = cubic feet per second.

flows for the Carlin Tunnels and Palisade gages for the period 1983-98.

High flows in the Humboldt River typically occur during the months of March, April, May, and June; low flows are usually measured in August, September, and October. Average monthly flows for the Humboldt River at the Palisade and Carlin gages for the period 1903-98 are presented in **Table 3-6**. Flow averages for the pre-mining years (prior to 1980), the years of large scale mining (1992-1998), and all years are included. The flows for the current mining period (since 1992) are higher than the average flows prior to 1980. Average baseflow for the Humboldt River (October measurements) is 58.8 cfs at the Palisade gage. Baseflows in the Humboldt River can vary during and between years because of the recharge/discharge dynamics of the river.

Average monthly flow during March through June (1903 to 1998) at the USGS Palisade station ranged from about 597 to 1,208 cfs. In July, average flow declined to 353 cfs. Average flow was less than 65 cfs from August through October during the same period of record. Average annual gain in flow between the Carlin and Palisade gages was 51 cfs for the period 1946-90; average baseflow gain in the same reach was 18.4 cfs (RTi, 1999). After gaining in the reach between the Carlin and Palisade stations, the Humboldt River loses an average of 126 cfs from the Palisade station to Rye Patch Reservoir due to natural phenomena (e.g., infiltration and evapotranspiration) and agricultural diversions (RTi, 1999).

Flooding in the Humboldt River Basin occurs under three typical conditions: (1) in winter as a result of rain on snow or frozen ground; (2) in spring as a result of rising temperatures that melt snow; and (3) in summer as a result of short-duration, high-intensity storms. In the Carlin area, winter and spring flows have caused the greatest flood, erosion, and sediment damage (French, Nicholson, and Cooper, 1991).

Peak flows recorded at the Palisade gage in 1983 and 1984 were 6,380 cfs and 7,820 cfs, respectively. Flood-frequency data for the Humboldt River show that flow equals or exceeds 10 cfs 92 percent of the time at the Carlin gage, and 99.7 percent of the time at the Palisade gage (Stone and Leeds, 1991). A discharge rate of 1,000 cfs is exceeded 11 percent and 16 percent of the time at the Carlin and Palisade gages, respectively.

Maggie Creek. Maggie Creek flows 41 miles southward to its confluence with the Humboldt River near Carlin. The Maggie Creek drainage area is approximately 400 square miles. Immediately north of the South Operations Area, Maggie Creek is confined by Maggie Creek Canyon, or the "narrows." This bedrock feature divides the Maggie Creek Basin into upper and lower basins. Maggie Creek flows generally as a perennial stream above the canyon and as an intermittent stream through most of the lower basin.

Flow gaging on Maggie Creek by the USGS began in 1913 at a station located above its confluence with the Humboldt River (location not certain). Continuous flow monitoring at this station was discontinued in 1924.

TABLE 3-6
AVERAGE MONTHLY FLOW FOR THE HUMBOLDT RIVER AT PALISADE AND CARLIN GAGING STATION AND LOWER MAGGIE CREEK

Month	Average Daily Flow (cfs)								
	Humboldt River at Carlin Tunnel (Water Years 1944-1998)			Humboldt River at Palisade (Water Years 1903-1906, 1912-1998)			Maggie Creek Near Mouth (Water Years 1913-1924, 1992-1998)		
	Pre-Mining Years 1944-1991	Mining Years 1992-1998	All Years 1944-1998	Pre-Mining Years 1903-1906, 1912-1991	Mining Years 1992-1998	All Years 1903-1906, 1912-1998	Pre-Mining Years 1913-1924	Mining Years 1992-1998	All Years 1913-1924, 1992-1998
January	141.9	138.9	141.6	142.8	192.9	146.7	5.4	35.0	17.2
February	279.7	214.5	271.4	289.9	265.1	288.0	21.0	32.6	25.6
March	511.9	619.7	525.6	580.1	804.5	597.3	55.8	118.4	80.8
April	743.0	663.0	732.8	873.1	805.5	867.9	100.6	111.4	104.5
May	994.9	1132.3	1012.4	1008.2	1213.4	1024.0	98.2	89.3	94.7
June	1236.7	1542.2	1275.6	1179.5	1545.7	1207.7	19.6	37.0	26.8
July	349.6	464.6	364.3	339.7	507.9	352.6	3.5	11.8	6.7
August	52.4	73.2	55.0	59.4	91.1	61.8	2.1	9.6	5.0
September	26.3	31.3	26.9	35.7	54.4	37.2	1.4	10.5	4.9
October	45.7	33.6	44.4	58.7	61.0	58.8	4.3	13.4	7.7
November	78.4	50.5	74.8	88.8	82.4	88.3	4.4	20.0	10.3
December	101.3	72.0	97.6	106.1	103.7	105.9	3.5	21.3	10.2

Source: USGS, 1999
cfs = cubic feet per second

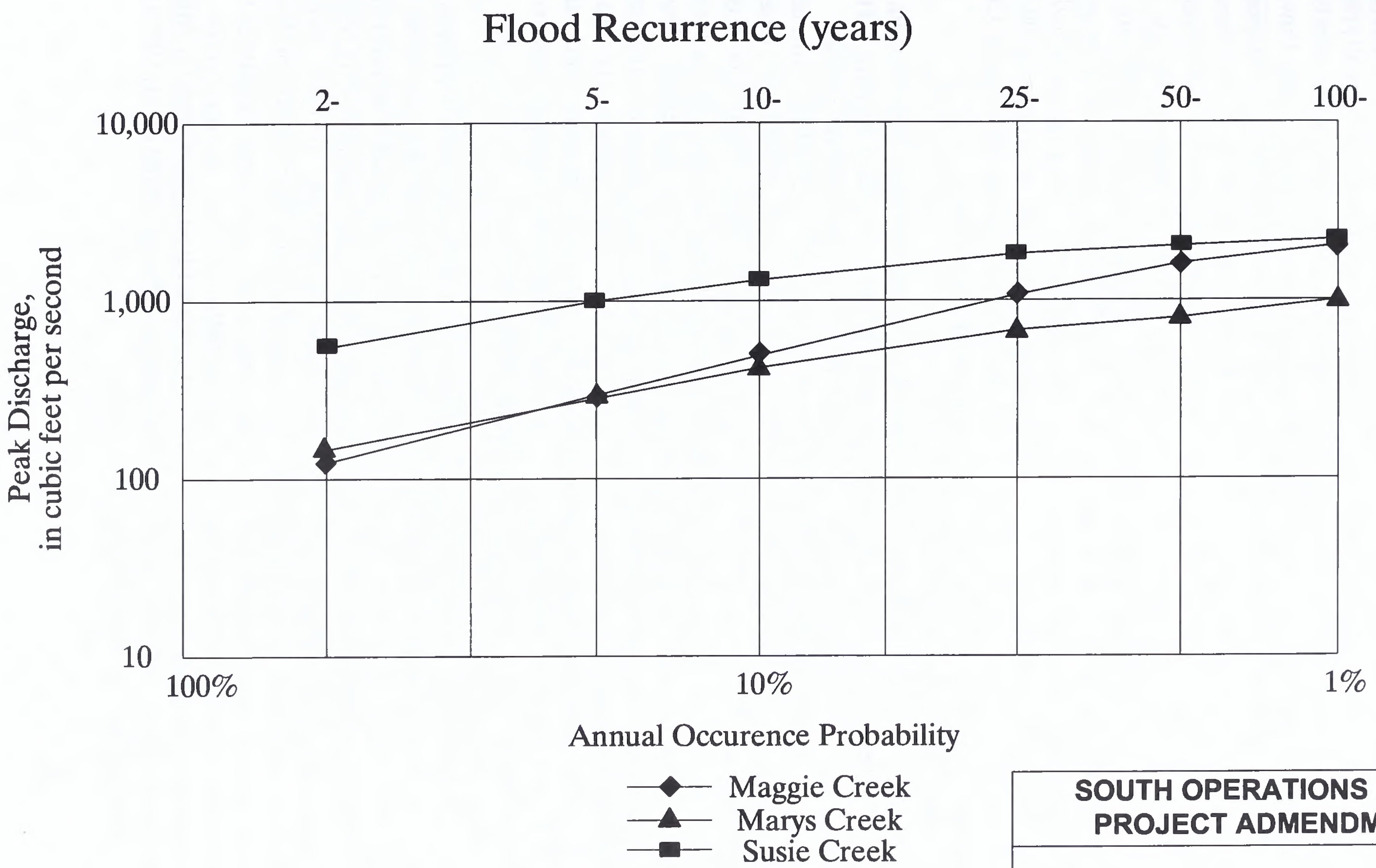
Currently, the USGS operates three gaging stations on Maggie Creek, installed in 1989, 1992, and 1996 (**Figure 3-2**). The new station is installed in upper Maggie Creek above Maggie Creek Canyon (upstream of MAG 5), one station is located below the Narrows (MAG 3), and the lower station is located near the Humboldt River. The lower gage was replaced in April 1992 with one closer to the Humboldt River (MAG 1).

During the 1913-1924 period of record, average daily discharge of lower Maggie Creek was 26.6 cfs (USGS, 1999). Average monthly flows at the station near the Humboldt River during the period from 1913 to 1998 are presented in **Table 3-6**. In general, average monthly flow in Maggie Creek at the mouth is less than 10 cfs during 7 months of the year, and nearly 100 cfs during the months of April and May. The USGS has measured flow at several locations along Maggie Creek on the same day to evaluate water gain or loss. Flow measurements during the period 1988-92 suggest that Maggie Creek gains in flow above Maggie Creek Canyon, and loses water through and below the canyon. For example, in June 1991 flow increased from 3.2 cfs in upper Maggie Creek to approximately 7 cfs just above the canyon; flow decreased to about 5.4 cfs at the lower end of the canyon and continued to decrease to 0.14 cfs near its confluence with the Humboldt River (USGS, 1992 as seen in BLM, 1993). During periods of low streamflow, there often is no flow in Maggie Creek at its confluence with the Humboldt River.

Point flow measurements by Newmont in Maggie Creek began in Spring 1993 at two stations above Maggie Creek Canyon (MAG 4 and MAG 5), and in January 1994 in the lower basin (MAG 2) and February 1994 at Maggie Creek above Cottonwood Creek (**Figure 3-2**). Point measurements are not necessarily indicative of actual maximum flows, since high flows occur only over short time periods which might be missed with monthly measurements. However, high point flows give a good indication of flow rates commonly occurring during high flow times. Low flow rates are good indicators of baseflow rates, since low flow rates tend to be constant for a longer period of time. High flows in Maggie Creek occurred in March 1993 and March 1996, with more than 100 cfs measured at all stations. In summer and fall lower Maggie Creek commonly dries up, while upper Maggie Creek maintains flow rates of 0.2 to 0.5 cfs (**Table 3-7**).

The greatest peak discharge on record for Maggie Creek is 2,440 cfs, measured in February 1962. Based on flood frequency curves, flow without mining water discharge at the lower end of Maggie Creek is 1 cfs or more 72 percent of the time and 100 cfs or more 8 percent of the time. A flow of 13 cfs or more can be expected 25 percent of the time (Stone and Leads, 1991). A flood frequency curve for Maggie Creek is presented in **Figure 3-3**.

Susie Creek. Susie Creek is a perennial stream that flows 29 miles south to the Humboldt River and has a drainage area of approximately 212 square miles. A USGS surface water station was installed near the mouth of Susie Creek in April 1992 (SCS-6). In addition, Newmont has established five stream flow measurement sites (SCS-1 through SCS-5) along Susie Creek (**Figure 3-2**). In most years the reach near the gaging station and approximately one mile upstream is typically dry in the months July to October (Newmont, 1999c). Flow of Susie Creek at a point 16 miles above its confluence with the Humboldt River was measured by the USGS during the period 1956-58. Average annual



Marys Creek and Susie Creek calculated after the Regression Formula.
Maggie Creek after Data in Appendix, both in Thomas et al., 1994

SOUTH OPERATIONS AREA PROJECT ADMENDMENT	
FIGURE 3-3 FLOOD FREQUENCY CURVES	
DATE: 7/24/00	ACAD FILE: Fig3-3.DWG
SCALE: NTS	DRAWN BY: PBE

flow at this location was about 6 cfs with average monthly flows ranging from 0.11 to 29.3 cfs (USGS, 1963). Maximum annual flows for the 3 years of measurement were 184, 161, and 89 cfs (USGS, 1963). Flow data on file with BLM show a high flow of 60 cfs recorded for April 30, 1985, at a location approximately 4 miles above Susie Creek's mouth. At the USGS surface water station on Susie Creek near its mouth, average annual flow is about 10 cfs for the period 1992 to 1998. In 1999, April flows peaked at about 424 cfs (USGS, 1999b) **(Table 3-7)**.

A flood frequency curve for Susie Creek is shown on **Figure 3-3.** As a result of changes in grazing management, the lower reaches of Susie Creek are currently in excellent condition and support an extremely productive wet meadow/beaver dam complex with flowing water and abundant wildlife use. (See photos in **Appendix A.**)

Marys Creek. Marys Creek flows approximately 13 miles southeast before entering the Humboldt River west of Carlin. The Marys Creek drainage area is approximately 75 square miles. A continuous-recording USGS stream gage has been operating on Marys Creek below Carlin Springs since November 1989 (Lower Marys). The gage shows maximum and minimum daily discharges of 400 and 0.6 cfs, respectively (USGS, 1999) (**Table 3-7**). Flow at the surface water station typically shows a sharp decline in April or May corresponding to the cessation of surface water runoff from Marys Mountain (Newmont, 1999c). The town of Carlin obtains its municipal water from the springs, which affects flow measurements downstream at the gaging station.

Newmont conducts point measurements at Upper Marys Creek (Mary 0). The flow is intermittent with high flows typically recorded in March and April and low flows in October and November. In 1998, April flows were measured at about 20 cfs. In October 1994, low flows were about 0.01 cfs (Newmont, 1999c). Trench et al. (1991) calculated that a 100-year flood on Marys Creek would produce a scale flow of 2,600 cfs at the Interstate 80 bridge, according to the equation in Thomas (1994). The 100-year flood would produce a peak flow of around 1,000 cfs. A flood frequency curve for Marys Creek is shown on **Figure 3-3**.

James, Soap, Simon, Cottonwood, Jack, Little Jack, Coyote, Spring, Haskell, Beaver, Fish, and Taylor creeks. All of these creeks are intermittent tributaries of Maggie Creek north of the South Operations Area except for James Creek which is also a tributary of Maggie Creek, but is located on the southern end of the South Operations Area. Several of the Maggie Creek tributary drainages are typically dry or are outside the area of potential impacts and are not monitored including Haskell, Beaver, Fish, and Taylor creeks.

James Creek flows for about 6 miles southeast to its confluence with Maggie Creek. Upper James Creek as measured at station James 0 is perennial with maximum flows in March and low flows in October. In 1995, May flows were measured at about 9.3 cfs and low flows in June 1994 were approximately 0.2 cfs (Newmont, 1999c). James Creek at its confluence with Maggie Creek (JAMES 1) is dry most of the year (Newmont, 1999) (**Table 3-7**).

TABLE 3-7
SUMMARY OF FLOWS IN SMALL CREEKS IN SOAPA STUDY AREA THROUGH DECEMBER 1998

Gaging Station[1]	Minimum Flow (As Measured With Point Measurements[3])		High Flow (As Measured With Point Measurements[3])	
(Start of Measurements)	cfs[2]	Month-Year	cfs	Month-Year
COYOTE 0 (Jun-93)	0.2	Aug-94	43.08	May-96
COYOTE 1 (May-93)	dry	Jan-94 - May-95, Jul-95 - Feb-96, Jun-96 - Jan-97, Jul-97-Dec-97, Jul-98- Dec-98	28.61	May-96
JACK 0 (May-93)	0.058	Oct-94	4.96	May-96
JACK GS (Jun-93)	dry	Oct-94 - Jan 95	21.37	Mar-96
JACK 1 (May-93)	dry	Jun-93 - Feb-94, May-94 - Jan-96, Jun-96 - Dec-96, Jun-97 - Jan-98, Jul-98-Dec-98	24.45	Mar-96
JAMES 0 (Apr-93)	0.174	Jun-94	9.3	May-95
JAMES 1 (May-93)	dry	May-93 - Feb-95, Jun-95 - Jan-96, May-96 - Nov-96, Jun-98-Oct-98	10.03	Apr-96
LJACK 0 (May-93)	0.02	Oct-94	26.04	Mar-96
LJACK 1 (May-93)	dry	Jun-93 - Jul-93, Dec-93 - Jan-96, Jun-96 - Dec-96, Jun-97-Dec-97, Jun-98-Dec-98	19.87	Mar-96
LYNN 0 (Jul-93)	0.055	Jul-94	3.39	Mar-96
MACK 0 (Jun-93)	0.01	Aug-94	11.8	Apr-98
COTTONWOOD (Mar-94)	dry	Mar-94 - Feb-95, Aug-95 - Sep-95, Nov-95 - Jan-96, Jul-96 - Dec-96, Sep-97-Dec-97, Jun 98-Dec-98	2.16	Mar-97
MAG 1[4] (Apr-92)	dry	Jul-92 - Aug-93, Feb-93 Jan-94, Jul-94	640	Mar-93
MAG 2 (Jan-94)	dry	Jul-94 - Nov-94, Aug-95 - Sep-95, Jul-96 - Sep-96	160.57	Apr-98
MAG 3[4] (Sep-89)	dry	Jul-91-Sep-91, Jul-92-Oct-92 Jul-94-Nov-94 Aug-96	520	Mar-93
MAG 4 (Apr-93)	0.006	Sep-94	150.02	Mar-96

TABLE 3-7 (continued)
SUMMARY OF FLOWS IN SMALL CREEKS IN SOAPA STUDY AREA THROUGH DECEMBER 1998

Gaging Station[1]	Minimum Flow (As Measured With Point Measurements[3])		High Flow (As Measured With Point Measurements[3])	
MAG 5 (Mar-93)	0.45	Jul-94	354.25	Mar-93
MAG above COT (Feb-94)	0.21	Aug-94	163.18	Mar-96
MARYS 0 (Apr-93)	0.01	Oct-94	20.19	Apr-98
Lower Marys[4] (Nov-89)	0.6	Aug-91	400	Mar-93
SIMON 0 (Apr-93)	dry	Jul-93, Jul-94 - Oct-94, Jul-95 - Oct-95, Dec-95 - Aug-97, Sep-97, Dec-98	2.99	May-93
SIMON 1 (May-93)	0.072	Mar-94	10.28	Feb-94
SPRING CREEK (Jul-93)	0.303	Feb-94	12.2	May-96
SUSIE CREEK				
SCS1 (Apr-93)	1.07	Jul-93	51.58	Mar-98
SCS2 (Jun-93)	1.36	Jun-94	50.11	Mar-98
SCS3 (Jun-93)	0.76	Jun-94	35.81	Apr-96
SCS4 (Sep-93)	0.27	Jan-94	39.23	Apr-97
SCS5 (Sep-93)	dry	Jun-94 - Sep-94, Aug-95	80.86	Mar-98
SCS6[4] (Apr-92)	dry	Jun-92 - Oct-92 Jul-93 - Sep-93 Jul-94 - Oct-94 Jul-95 - Oct-95 Jul 96-Sep 96, Aug-98	424	Mar-97
WELCHES TRIB (Sep-93)	0.093	Aug-94	7.51	May-98
WELCHES 0 (May-93)	dry	Sep-94 - Dec-94	10.32	May-98

Source : Newmont, 1999c.

[1] Location of the gaging stations can be found in **Figure 3-2.** Parentheses indicate start date of measurement.

[2] cfs = cubic feet per second

[3] Point measurements are not necessarily indicative of actual maximum flows, since high flows occur only over short time periods which might be missed with monthly measurements. However, maximum point flows give a good indication of flow rates commonly occurring during high flow times. Low flow rates are good indicators of base flow rates, since low flow rates tend to be constant for a longer period of time.

[4] U. S. Geological Survey gage, values given are lowest daily mean and highest daily mean, data reported up to October 1998 (U. S. Geological Survey, 1999b).

Simon Creek flows for about 7 miles southeast to its confluence with Maggie Creek. Simon Creek is typically ephemeral in its upper reaches and perennial at its mouth as recorded at monitoring stations Simon 0 and Simon 1, respectively. The USGS began operating a surface water station at the mouth of Simon Creek in November 1996, which replaced Newmont's Simon 1 station. In lower Simon Creek (Simon 1), peak flow generally occurs in February and March and low flows are in July through October. In 1994, flow was measured in February at a rate of about 10 cfs, and then dropped rapidly to about 0.07 cfs by March. In 1996, September flows were about 0.6 cfs. Lynn Creek is a tributary to Simon Creek and flows about eight miles southeast to its confluence near Maggie Creek. Data for Lynn Creek (Lynn 0) indicate peak flows in March and low flows in July through December. In 1996, flows of about 3.4 cfs were measured in mid-March with low flows of about 0.06 cfs in July through December (**Table 3-7**).

Cottonwood Creek flows for about 6 miles southwest to its confluence with Maggie Creek. Cottonwood Creek is ephemeral with maximum flows in March or April. Cottonwood Creek is normally dry from August through January. In 1997, flows of about 2 cfs were recorded in mid-March. In 1996, the stream was dry from late-July through mid-December (**Table 3-7**).

Jack Creek flows for about 10 miles southeast to its confluence with Maggie Creek. Jack Creek has two named tributaries, West Cottonwood Creek and Indian Creek. Data from Upper Jack Creek at monitoring station Jack 0 shows perennial flow while data from lower Jack Creek above Maggie Creek (Jack 1) indicates ephemeral flow. Middle Jack (Jack GS) is ephemeral. In 1996, the peak flow in lower Jack Creek was about 24 cfs in mid-March. Lower Jack Creek was dry from mid-June through early December (**Table 3-7**).

Little Jack Creek parallels Jack Creek to the north, flowing about 13 miles to its confluence with Maggie Creek. Data from Upper Little Jack Creek at monitoring station LJack 0 indicate perennial flow while data from lower Little Jack Creek above Maggie Creek (LJack 1) indicate ephemeral flow. In 1996, the high flow in lower Little Jack Creek was about 20 cfs in mid-March. Little Jack Creek was dry from mid-June through early December (**Table 3-7**).

Fish Creek is a small west-draining tributary to Maggie Creek upstream of Little Jack Creek. A monitoring station has not been established on Fish Creek. However, an aquatic habitat survey (JBR, 1992) indicates mean flow of the intermittent stream is 0.185 cfs.

Coyote Creek is the first drainage north of Fish Creek. Coyote Creek flows for about 11 miles southeast to its confluence with Maggie Creek. Data from upper Coyote Creek at monitoring station Coyote 0 indicates perennial flow while data from lower Coyote Creek above Maggie Creek (Coyote 1) indicates ephemeral flow. In 1996, the high flow in lower Coyote Creek was about 29 cfs in mid-May. Lower Coyote Creek was dry from mid-June through late January (**Table 3-7**).

Spring Creek is a small drainage directly north of Coyote Creek. Spring Creek flows southeast for approximately 2 miles to Maggie Creek. Flow data from a monitoring station located near the mouth of Spring Creek shows perennial flow. In 1996, the high flow was

about 12 cfs in May. In 1994, a low flow was recorded in February at about 0.3 cfs (**Table 3-7**).

Flow data are not available for Haskell, Beaver, or Taylor creeks.

Welches and Mack creeks. These creeks drain into the Boulder Flat Drainage Basin. Both streams are perennial in the upper reaches and ephemeral in the lower reaches. Flow data from Lower Welches (Welches 0) show a high flow of about 10.3 cfs in May 1998. Lower Welches was dry from September to December 1994. High flow in Mack Creek was about 12 cfs in April 1998 and low flows were recorded in August 1994 at about 0.01 cfs (**Table 3-7**).

Surface Water Quality

Surface water in the upper Humboldt River Basin is generally a calcium-bicarbonate type with hardness and pH ranges of 100 to 250 milligrams per liter (mg/L) and 6.5 to 9.0, respectively. Total dissolved solids generally are less than 500 mg/L. Dissolved oxygen typically is in the range of 2.4 to 15 mg/L (Newmont, 1999c). Newmont (1999c) has collected surface water samples since April 1990 from four sites on Maggie Creek and eight sites on the Humboldt River. Newmont currently monitors surface water on the Humboldt River at two sites only (HUM-1 and HUM-5) (**Figure 3-2**). The USGS also collects water quality samples at selected streams and the Humboldt River in the study area. Relatively little variation in chemistry occurs during the low and high flow regimes, and when comparing samples collected from upstream and downstream stations. **Table 3-8** contains a summary of water quality data from the Newmont monitoring stations on the Humboldt River and Maggie Creek.

Naturally occurring concentrations of metals in surface water in the project area are generally low or do not exceed detection limits. However, several trace metals measured in the Humboldt River and/or Maggie Creek have exceeded drinking water quality standards, including silver, cadmium, chromium, iron, manganese, and lead (**Table 3-8**). Quality of water in Maggie Creek generally is better than in the Humboldt River in the study area.

A summary of the water samples collected between 1992 and 1997 from Jack, Simon, Marys, and Susie creeks is presented in **Table 3-9**. In all four creeks, concentrations of iron and manganese higher than the drinking water standards were measured. Simon Creek also exceeded drinking water standards for arsenic and selenium.

Temperature of surface water in the project area varies considerably throughout the year, and seems to be more dependent on ambient air temperature than discharge rate. During summer, water temperatures in Maggie Creek and the Humboldt River typically are in the range of 15 to 25°C (**Table 3-10**). In winter, surface water temperatures generally are less than 10°C. An exception is temperature at station HUM-6, which is much higher due to the Carlin Hot Springs discharge into the river. Maximum recorded water temperatures in Maggie Creek and the Humboldt River (except at HUM-6) during the period 1994-98 is 26.0°C. Water temperature in Maggie Creek generally increases downstream; for example, in March 1996, Maggie Creek temperature was 9.5°C north of the South Operations Area and 11.3°C near its confluence with the Humboldt River. Temperature variations along the Humboldt River are less pronounced in the project area; however, temperature increases typically are observed in the river for

TABLE 3-8
SUMMARY OF WATER QUALITY FOR MAGGIE CREEK AND HUMBOLDT RIVER

Station[1] (Period of Measurements)	Minimum / Average / Maximum — TOTAL CONCENTRATION RANGES[2,3]															
	Temp C°	pH	Hard	TDS	TSS	Turb	Ag[4]	As	Ba	Cd[4]	Cr	DO	Fe	Hg	Mn	Pb[4]	Se
MAG-1 (1990-1998)	5.1	7.35	120	222	bdl	bdl	bdl	bdl	bdl	bdl	bdl	4.40	bdl	bdl	bdl	bdl	bdl
	15.6	8.33	189	335	74.4	22.9	0.004	0.013	0.15	0.003	0.011	7.72	1.09	0.0002	0.080	0.007	0.003
	24.5	9.00	217	410	1100.0	280.0	0.005	0.033	0.86	0.005	0.022	12.16	30.00	0.0004	0.930	0.060	0.001
MAG-2 (1990-1996)	0.0	6.90	120	230	bdl	bdl	bdl	bdl	bdl	bdl	bdl	2.99	0.02	bdl	bdl	bdl	bdl
	12.6	8.25	187	339	57.4	18.7	bdl	0.009	0.17	bdl	0.011	7.02	1.45	0.00	0.076	0.007	bdl
	25.7	9.10	220	580	1000.0	280.0	bdl	0.019	0.92	bdl	0.022	11.86	31.00	0.00	0.930	0.017	0.008
MAG-3 (1990-1998)	0.2	7.20	102	221	bdl	bdl	bdl	bdl	bdl	bdl	bdl	3.20	bdl	bdl	bdl	bdl	bdl
	12.2	8.28	174	319	45.3	16.2	bdl	0.007	0.12	0.004	0.008	8.52	0.84	0.0002	0.079	0.005	0.003
	24.4	10.00	217	490	650.0	180.0	bdl	0.014	0.62	0.010	0.015	14.73	21.00	0.0003	0.620	0.011	0.003
MAG-4 (1990-1996)	0.3	6.96	110	217	bdl	bdl	bdl	bdl	bdl	bdl	bdl	3.10	bdl	bdl	bdl	bdl	bdl
	11.0	8.23	177	308	24.1	10.1	0.004	0.003	0.08	0.003	0.009	7.89	0.59	0.0002	0.038	0.006	0.003
	23.5	9.50	196	800	290.0	160.0	0.011	0.012	0.33	0.006	0.009	12.40	14.00	0.0003	0.350	0.017	0.012
HUM-1 (1990-1998)	0.4	7.06	110	182	bdl	1.0	bdl	bdl	bdl	bdl	bdl	4.17	bdl	bdl	bdl	bdl	bdl
	12.1	8.15	149	284	91.8	34.2	0.008	0.006	0.12	0.003	0.009	8.30	1.26	0.0002	0.098	0.006	0.003
	24.1	8.72	190	356	771.0	260.0	0.096	0.019	0.54	0.006	0.018	15.34	24.00	0.0006	0.690	0.014	0.005
HUM-2 (1990-1996)	1.0	7.10	120	217	bdl	0.8	bdl	bdl	bdl	bdl	bdl	4.20	bdl	bdl	bdl	bdl	bdl
	13.0	8.12	164	311	84.7	28.6	0.005	0.008	0.14	0.004	0.012	7.27	1.44	0.0002	0.091	0.007	bdl
	22.0	8.63	238	390	850.0	300.0	0.012	0.018	0.57	0.021	0.100	11.10	25.00	0.0004	0.770	0.015	bdl
HUM-3 (1990-1997)	0.6	7.20	110	217	bdl	0.8	bdl	bdl	bdl	bdl	bdl	3.70	bdl	bdl	bdl	bdl	bdl
	12.3	8.12	151	316	298.2	31.1	0.005	0.008	0.15	0.004	0.011	7.18	1.68	0.0002	0.106	0.008	0.003
	24.0	8.50	184	414	7100.0	300.0	0.014	0.018	0.68	0.013	0.021	11.60	28.00	0.0009	0.810	0.035	0.012
HUM-4 (1990-1996)	2.0	7.14	120	219	bdl	0.8	bdl	bdl	bdl	bdl	bdl	3.69	0.05	bdl	bdl	bdl	bdl
	14.4	8.08	157	321	90.9	29.8	0.004	0.009	0.14	0.004	0.012	7.52	1.62	0.0002	0.101	0.006	bdl
	24.2	8.51	200	450	1100.0	300.0	0.005	0.030	0.71	0.009	0.100	10.10	31.00	0.0008	0.890	0.017	bdl
HUM-5 (1991-1998)	1.7	7.15	110	170	bdl	0.7	bdl	bdl	bdl	bdl	bdl	4.05	0.04	bdl	bdl	bdl	bdl
	13.4	8.17	150	302	120.4	43.2	0.004	0.007	0.15	0.003	0.018	8.51	1.57	0.0002	0.101	0.007	0.003
	23.0	8.50	185	372	1200.0	351.0	0.018	0.020	0.86	0.005	0.380	14.34	36.00	0.0008	1.000	0.050	0.005

TABLE 3-8 (continued)
SUMMARY OF WATER QUALITY FOR MAGGIE CREEK AND HUMBOLDT RIVER

Station[1] (Period of Measurements)	Minimum Average Maximum TOTAL CONCENTRATION RANGES[2,3]																
	Temp C°	pH	Hard	TDS	TSS	Turb	Ag[4]	As	Ba	Cd[4]	Cr	DO	Fe	Hg	Mn	Pb[4]	Se
HUM-6 (1991-1996)	8.7	6.75	120	218	bdl	bdl	bdl	bdl	0.11	bdl	bdl	2.40	bdl	bdl	bdl	bdl	bdl
	14.0	7.88	171	368	368.4	27.5	0.004	0.011	0.26	0.003	0.013	4.72	1.54	0.0002	0.107	0.007	0.003
	24.2	8.28	195	452	1000.0	300.0	0.005	0.027	0.65	0.007	0.130	9.98	27.00	0.0003	0.900	0.020	0.009
HUM-7 (1991-1996)	5.4	7.70	119	210	bdl	1.7	bdl	bdl	bdl	bdl	bdl	3.44	0.09	bdl	bdl	bdl	bdl
	15.8	8.13	154	310	309.8	33.7	bdl	0.009	0.15	0.00	0.009	7.53	1.89	0.0001	0.110	0.007	0.003
	29.7	8.41	190	395	990.0	280.0	bdl	0.036	0.68	0.01	0.020	12.66	28.00	0.0002	0.850	0.050	0.005
HUM-8 (1991-1996)	5.9	7.10	119	224	bdl	0.7	bdl	bdl	bdl	bdl	bdl	3.90	0.07	bdl	bdl	bdl	bdl
	15.9	8.04	155	311	311.3	30.9	bdl	0.011	0.15	0.00	0.011	7.02	1.70	0.0002	0.103	0.007	0.003
	29.5	8.46	190	380	1000.0	320.0	bdl	0.050	0.72	0.01	0.020	10.70	29.00	0.0008	0.890	0.018	0.002

Source: Newmont, 1999c.
Note: Mean values were calculated assuming half detection limit for values below detection limit.

1 MAG-1 through MAG-4 are located on Maggie Creek; HUM-1 through HUM-8 are located on the Humboldt River; HUM-6 is located where the Carlin Hot Spring discharges into the Humboldt River; see **Figure 3-2** for station locations. All samples collected by Newmont. All four stations on Maggice Creek are within the Class C designation; all stations on the Humboldt River, except HUM-5 (Palisade), are within the Palisade control point designation.
2 Samples collected generally quarterly during 1990-97; DO=dissolved oxygen (field measured); TDS = total dissolved solids; TSS = total suspended solids; Turb. = turbidity; Hard. = Hardness; Ag = silver; As = arsenic; Ba = barium; Cd = cadmium; Cr = chromium; Fe = iron; Hg = mercury; Mn = manganese; Pb = lead; Se = selenium; °C = degrees celsius; SU = standard pH units (lab measured); mg/L = milligrams per liter; NTU = nephelometric turbidity units; min = minimum; max = maximum; bdl = below detection limits.
3 All concentrations reported are primary drinking water standards unless followed by (s) indicating secondary standards.
4 Ag, Cd, and Pb concentrations are calculated based on a hardness of 175 mg/L representative of Maggie Creek and the Humboldt River.

TABLE 3-9
SUMMARY OF WATER QUALITY FOR JACK CREEK, SIMON CREEK, MARYS CREEK AND SUSIE CREEK[1]

Minimum / Average / Maximum — TOTAL CONCENTRATION RANGES[1,2,3]

	Temp	pH	TDS	TSS	Turb	Ag[4]	As	Ba	Cd[4]	Cr	Fe	Hg	Mn	Pb[4]	Se
Jack Creek	1.8	7.05	128	bdl	0.3	bdl	bdl	0.06	bdl	bdl	bdl	bdl	bdl	bdl	bdl
(1992-1996)	12.9	8.53	237	29.7	6.9	0.004	0.004	0.10	bdl	bdl	0.63	0.0003	0.033	0.007	0.002
	23.2	9.76	290	174.0	44.0	0.009	0.013	0.17	bdl	0.005	6.20	0.0003	0.250	0.020	0.002
Marys Creek	0.2	7.07	150	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
(1992-1998)	13.7	8.05	300	130.7	40.6	bdl	0.004	0.08	bdl	bdl	0.23	bdl	0.076	0.006	0.004
	26.0	8.55	426	1970.0	486.0	bdl	0.009	0.15	bdl	0.005	1.19	bdl	1.460	0.010	0.010
Simon Creek	3.2	7.49	351	bdl	0.5	bdl	0.008	0.10	bdl	bdl	bdl	bdl	bdl	bdl	bdl
(1993-1998)	13.0	8.20	827	39.2	13.2	bdl	0.036	0.12	bdl	bdl	0.30	bdl	0.045	0.005	0.024
	25.3	8.58	1950	292.0	61.9	bdl	0.300	0.17	bdl	0.006	2.50	0.0002	0.134	0.008	0.440
Susie Creek	0.0	7.40	141	bdl	0.4	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
(1992-1998)	12.0	8.20	289	208.8	63.9	bdl	0.007	0.22	bdl	0.006	1.95	bdl	0.103	0.006	bdl
	28.2	8.65	388	1640.0	413.0	bdl	0.014	0.63	bdl	0.017	32.00	0.0001	0.880	0.026	bdl

Source: Newmont, 1999c.

Note: Average values were calculated assuming half detection limit for values below detection limit.

1 See **Figure 3-2** for location of monitoring sites.

2 Concentration ranges of samples collected generally quarterly during 1992-1997; TDS = total dissolved solids; TSS = total suspended solids; Turb. = turbidity; Ag = silver; As = arsenic; Ba = barium; Cd = cadmium; Cr = chromium; Fe = iron; Hg = mercury; Mn = manganese; Pb = lead; Se = selenium; °C = degrees Celsius; SU = standard pH units (lab measured); µg/l = milligrams per liter, NTU = nephelometric turbidity units; bdl = below detection limit.

3 All concentration reported are primary drinking water standards (see Table 3-14).

4 Ag, Cd, and Pb concentrations are calculated based on a hardness of 175 µg/l representative of Maggie Creek and the Humboldt River.

TABLE 3-10
WATER TEMPERATURES IN MAGGIE CREEK AND HUMBOLDT RIVER

Monitoring Site	Period of Record	Water Temperature[2] (°C) Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept
MAG-1	1990-1998	NR	NR	10	NR	NR	12	14	13	23	NR	23	17
MAG-2	1990-1996	NR	NR	3	NR	NR	9	11	11	22	NR	NR	26
MAG-3	1990-1998	NR	NR	3	NR	NR	10	8	10	20	18	22	18
MAG-4	1990-1996	NR	NR	3	NR	NR	8	6	9	19	NR	NR	18
HUM-1	1990-1998	NR	NR	3	NR	1	10	10	12	18	21	24	18
HUM-2	1990-1996	NR	NR	4	NR	NR	11	14	15	20	NR	NR	15
HUM-3	1990-1997	NR	NR	3	NR	NR	10	13	16	20	NR	NR	14
HUM-4	1990-1996	NR	NR	7	NR	5	12	17	20	20	NR	NR	19
HUM-5	1990-1998	NR	NR	4	NR	7	11	16	15	19	23	21	17
HUM-6	1991-1996	NR	NR	0.6	NR	19	2	20	7	20	NR	NR	18
HUM-7	1991-1996	NR	NR	10	NR	7	10	12	14	20	22	NR	26
HUM-8	1991-1996	NR	NR	NR	9	6	11	14	15	19	NR	NR	24
Humboldt River At Carlin Tunnels Gage[3]		6-15	2-8	1-6	0.5-2	1-5	4-9	6-15	11-19	15-22	17-24	21-23	9-21

Source: Newmont, 1999c; BLM, 1993. NR = No Record.

[1] MAG-1 through MAG-4 are located on Maggie Creek; HUM-1 through HUM-8 are located on the Humboldt River; HUM-6 is located where the Carlin Hot Spring discharges into the Humboldt River; see **Figure 3-2** for station locations. The four stations on Maggie Creek are within the Class C designation; all stations on the Humboldt River, except HUM-5, are within the Palisade control point designation (see **Tables 3-11 and 3-12**).

[2] Average temperature from instantaneous temperature measurement on 1 or 2 days within the month in degrees Celsius.

[3] Mean daily temperature range for the month from 1982-1991 in degrees Celsius.

a short distance downstream of the Carlin Hot Spring (station HUM-6, **Figure 3-2**).

Water quality data indicate some seasonal variation in TDS and turbidity with relatively high concentrations in the spring or high flow period and lower concentrations during late summer to early winter low flow periods. These variations may reflect snowmelt versus groundwater (Eakin and Lamke, 1966)

Water Quality Standards

Water quality standards for state waters have been established by the State of Nevada under the Nevada Water Pollution Control statutes NAC 445A.070 et seq.; Nevada Revised Statutes (NRS) 445A.447). Beneficial use categories include drinking water (municipal or domestic supply), irrigation, livestock watering, industrial, recreation (contact and non-contact), propagation of wildlife, and aquatic life. Nevada's water quality criteria and standards for applicable chemical parameters and beneficial use categories are presented in **Tables 3-11** and **3-12.** Water quality standards for the Humboldt River in the project vicinity have been established at the Palisade control point (**Table 3-13**) (NAC 445A.204).

Tributaries of Maggie Creek are designated Class A waters; Maggie Creek from where it is formed by tributaries to its confluence with Jack Creek is designated a Class B water; and Maggie Creek from its confluence with Jack Creek to the Humboldt River is considered Class C water (**Table 3-11**). Standards assigned to the rivers and streams consist of selected nonmetal parameters such as

TABLE 3-11
CLASS A, B & C WATER QUALITY STANDARDS FOR NEVADA

Item	Class A Specifications	Class B Specifications	Class C Specifications
Floating solids or sludge deposits	None attributable to human activities	Only such amounts attributable to human activities which will not make the waters unsafe or unsuitable as a drinking water source, injurious to fish or wildlife or impair the waters for any other beneficial use established for this class.	Only those amounts attributable to the activities of man which will not make the receiving waters injurious to fish or wildlife or impair the waters for any beneficial use established for this class.
Odor-producing substances	None attributable to human activities	Only such amounts which will not impair the palatability of drinking water or fish or have a deleterious effect upon fish, wildlife or any beneficial uses established for waters of this class.	Not specified.
Sewage, industrial wastes or other wastes	None allowed	None which are not effectively treated to the satisfaction of the department.	None which are not effectively treated to the satisfaction of the department.
Toxic materials, oil, deleterious substances, colored or other wastes	None allowed	Only such amounts as will not render the receiving waters injurious to fish or wildlife or impair the receiving waters for any beneficial use established for this class.	Only such amounts as will not render the receiving waters injurious to fish or wildlife or impair the receiving waters for any beneficial use established for this class.
Settleable solids	Only amounts attributable to human activities which will not make the waters unsafe or unsuitable as a drinking water source or which will not be detrimental to aquatic life or for any other beneficial use established for this class.	Only such amounts attributable to human activities which will not make the waters unsafe or unsuitable as a drinking water source, injurious to fish or wildlife or impair the waters for any other beneficial use established for this class.	Only those amounts attributable to the activities of man which will not make the receiving waters injurious to fish or wildlife or impair the waters for any beneficial use established for this class.
pH	Range between 6.5 and 8.5	Range between 6.5 and 8.5	Range between 6.5 and 8.5
Dissolved Oxygen	Must not be less than 6.0 μg/l[1].	For trout waters, not less than 6.0 mg/L; for non trout waters, not less than 5.0 mg/L.	For trout waters, not less than 6.0 mg/L; for nontrout waters, not less than 5.0 mg/L.

TABLE 3-11 (continued)
CLASS A, B & C WATER QUALITY STANDARDS FOR NEVADA

Item	Class A Specifications	Class B Specifications	Class C Specifications
Temperature	Must not exceed 20° C. Allowable temperature increase above natural receiving water temperature: None	Must not exceed 20° C for trout waters or 24° C for nontrout waters. Allowable temperature increase above natural receiving water temperatures: None	Must not exceed 20° C for trout waters or 34° C for nontrout waters. Allowable temperature increase above natural receiving water temperatures: 3° C
Fecal Coliform	The fecal coliform concentrations, based on a minimum of 5 samples during any 30-day period, must not exceed a geometric mean of 200 per 100 mL, nor may more than 10 percent of total samples during any 30-day period exceed 400 per 100 mL.	The fecal coliform concentrations, based on a minimum of 5 samples during any 30-day period, must not exceed a geometric mean of 200 per 100 mL, nor may more than 10 percent of total samples during any 30-day period exceed 400 per 100 mL.	See NAC 445A.126.
Total phosphate	Must not exceed 0.15 mg/L in any stream at the point where it enters any reservoir or lake, nor 0.075 mg/L in any reservoir or lake, nor 0.30 mg/L in streams and other flowing waters.	Must not exceed 0.3 mg/L.	Must not exceed 1.0 mg/L.
Total Dissolved Solids	Must not exceed 500 mg/L or one-third above that characteristic of natural conditions (whichever is less).	Must not exceed 500 mg/L or one-third above that characteristic of natural conditions (whichever is less).	Must not exceed 500 mg/L or one-third above that characteristic of natural conditions (whichever is less).

Source: NAC 445A.124-126.
[1] mg/L = milligrams per liter.

TABLE 3-12
WATER QUALITY CRITERIA AND STANDARDS FOR NEVADA

Parameter[1] (mg/L)	Drinking Water Std.		Municipal or Domestic Supply	Aquatic Life		Agriculture		
	Primary	Secondary		1-Hr Average	96-Hr Average	Irrigation	Stock Water	Wildlife Propagation
Antimony	0.006	--	0.146	--	--			
Arsenic	0.05	--	0.05	0.34 As(III)	0.18 As(III)	0.1	0.2	--
Barium	2.0	--	2.0	--	--	--	--	--
Beryllium	0.004	--	0	--	--	0.1	--	--
Boron	--	--	--	0.55	0.55	0.75	5.0	--
Cadmium	0.005	--	0.005	6.2[3]	1.5[3]	0.01	0.05	--
Chromium	0.1	--	0.10	0.015 Cr(VI)	0.01 Cr(VI)	0.1	1.0	--
Copper	(1.3)	--	--	25.3[3]	16.1[3]	0.2	0.5	--
Iron	--	0.3[0.6][2]	--	1.0	1.0	5.0	--	--
Lead	0.05	--	0.05	82.2[3]	1.6[3]	5.0	0.1	--
Magnesium	--		125/150	--	--			
Manganese	--	0.05[0.1]	--	--	--	0.2	--	--
Mercury	0.002	--	0.002	0.002	.000012	--	0.01	--
Molybdenum	--	--	--	0.19	0.19			
Nickel	0.1	--	0.0134	1,919[3]	213[3]	0.2	--	--
Selenium	0.05	--	0.05	0.020	0.005	0.02	0.05	--
Silver	0.05	--	--	8.9[3]	8.9[3]	--	--	--
Thallium	0.002	--	0.013	--	--	--	--	--
Zinc	--	5.0	--	159[3]	144[3]	2.0	25.0	--
Cyanide (WAD)	--	--	0.2	0.022	0.0052	--	--	--
Alkalinity	--	--	--	less than 25% change		--	--	30-130
Chloride	--	250[400]	250[400]	--	--	--	1,500	1,500
Color (PCU)	--	15	75	--	--	--	--	--
Dissolved Oxygen	--	--	Aerobic	5.0	5.0	--	Aerobic	Aerobic
Fluoride	4.0	2.0	--	--	--	1.0	2.0	--
Nitrate as N	10	--	10	90(w)	90(w)	--	100	100
pH (SU)	--	6.5-8.5	5.0-9.0	6.5-9.0	6.5-9.0	4.5-9.0	5.0-9.0	7.0-9.2
Sulfate	--	250[500]	250[500]	--	--	--	--	--
Temperature °C	--	--	--	Site specific determination		--	--	--
TDS	--	500[1,000]	500[1,000]	--	--	--	3,000-7,000	--
TSS	--	--	--	25-80	25-80	--	--	--
Turbidity (NTU)	--	--	--	50(w);10(c)	50(w);10(c)	--	--	--

Source: NAC 445.117; NAC 445.1339.

[1] mg/L = milligrams per liter; PCU = photoelectric color units; SU = standard units; NTU = nephelometric turbidity units; TDS = total dissolved solids;
TSS = total suspended solids; °C = degrees Celsius.

[2] Numbers in brackets [ ] are mandatory secondary standards for public water systems.

[3] Parameter dependent on hardness; see NAC 445.1339 for equations to determine concentration.

[4] (w) refers to warm water and (c) is for cold water. No letter designation indicates criteria are common to both warm and cold water.

TABLE 3-13
WATER QUALITY STANDARDS FOR HUMBOLDT RIVER AT PALISADE GAGE CONTROL POINT

Parameter[1] (mg/L)	Water Quality Standards for Beneficial Uses[2]	Most Restrictive Beneficial Use
Temp - °C	Δ≤ 2°C [3]	Aquatic life (warm water fishery)
pH - SU	6.5 - 9.0 Δ± 0.5 (single value)	Water contact recreation; wildlife propagation
Dissolved Oxygen	≥5.0 (single value)	Aquatic life (warm water fishery)
Chlorides	≤ 250 (single value)	Municipal or domestic supply
Total Phosphorus (as P)	≤ 0.1 (Apr- Nov season average)	Aquatic Life (warm water fishery)
Nitrates (N)	≤ 10 (single value, nitrate or nitrite)	Municipal or domestic supply
TDS	≤ 500 (annual average)	Municipal or domestic supply
TSS	≤ 80 (annual median)	Aquatic life (warm water fishery)
Color - PCU	No effects	Municipal or domestic supply
Turbidity - NTU	≥≤ 50 (single Value)	Aquatic life (warm water fishery)

Source: NAC 445A.204.

1 mg/L = milligrams per liter; °C = degrees Celsius; SU = standard pH units; TDS = total dissolved solids; TSS = total suspended solids; PCU = photoelectric color units; NTU = nephelometric turbidity units. Limits apply from the control point at Palisade gage upstream to the Elko control point.

2 Δ = change; all values are single value measurements, except nitrates and TDS, which are annual averages.

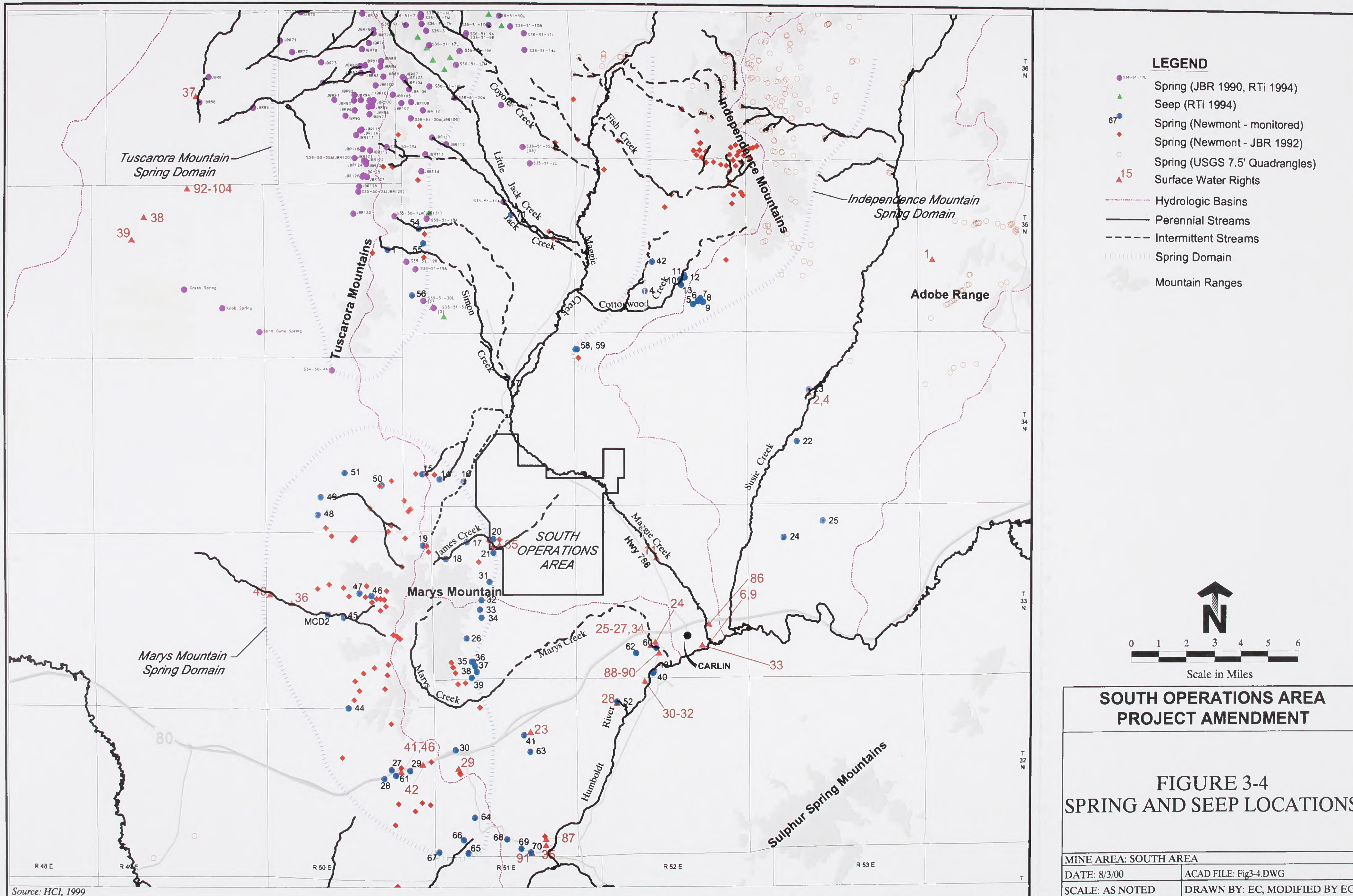
3 Maximum allowable increase in temperature at the boundary of an approved mixing zone.

temperature, pH, chloride, nitrate, total dissolved solids, and suspended solids. Water quality standards for metals and other selected parameters in surface water are presented in **Table 3-12**.

Quality of any waters receiving waste discharges must be such that no impairment of beneficial usage occurs as a result of the discharge (NAC 445A.120). Discharge permits are required from the NDEP, Bureau of Water Pollution Control for anyone who intends to discharge to state waters (NAC 445A.228-263).

Spring and Seep Surveys

Numerous springs and seeps have been inventoried by Newmont within a 10-mile radius of the South Operations Area (Newmont, 1999b) **(Figure 3-4)**. Information gathered during the field surveys includes geologic occurrence and control, development, vegetation type, water pH, dissolved oxygen content, water temperature, and flow rate. The 74 springs inventoried by Newmont in the study area since fall 1990 are shown in **Figure 3-4**. The spring locations are numbered from 1 to 73 plus MCD 2 (four of the earlier numbered springs have been dropped from the survey because they were redundant with other sampling, or they were in an area no longer of interest, or other reasons). The surveyed springs are not inclusive of all springs and seeps in the study area but were selected to be representative of the various spring types and location. JBR (1992b) conducted a comprehensive spring and seep inventory in May and June 1992 that identified approximately 195 springs and seeps. Some of these sites contain two or more springs, but were identified as only one site. Seeps and springs smaller than 200 square feet were generally not assessed unless part of a larger complex. In addition, a few seeps and springs may not have been found in this effort



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-4
SPRING AND SEEP LOCATIONS

MINE AREA: SOUTH AREA	
DATE: 8/3/00	ACAD FILE: Fig3-4.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY EG

and were thus not assessed. Additional springs outside the initially surveyed area were identified in surveys conducted for Barrick Goldstrike Mines (BLM, 2000b). The listing of all springs is on file with the BLM. In addition to all the above-mentioned surveys, springs in the Independence Mountains are mapped on USGS quadrangle maps. Springs in the Carlin Trend area have been categorized into several main types based on geologic control (Stone and Leeds, 1991; Balleau Groundwater Consulting, 1992). Discharge of water can occur at the contact of permeable and impermeable materials such as at faults, dikes, or other barriers. Some springs and seeps represent exposure of the water table in a depression or topographic low. Water can also be stored and released from localized areas of unconsolidated material such as colluvium. Water can be at artesian pressure (confined or semi-confined condition) or at atmospheric pressure (unconfined condition). Springs can be associated with extensive groundwater flow systems or they can be perched or "bounded" where the source is a relatively small, localized groundwater system separated from regional groundwater. Most springs and seeps in the project area are located at and above the base of mountains and far above the elevation of regional groundwater in adjacent valleys. According to Balleau Groundwater Consulting (1992), springs above an elevation of about 6,000 feet are typically isolated from the regional groundwater flow system.

Within a 10-mile radial distance of the Gold Quarry Mine, the majority of inventoried springs and seeps have flow rates of less than 5 gallons per minute (gpm). Of the 74 springs measured by Newmont, 15 springs (Newmont No. 14, 15, 16, 17, 18, 24, 27, 28, 42, 49, 50, 62, 66, 69, and 70) had average October Flows between 5 and 50 gpm, only 5 springs (Newmont No. 21, 52, 57, 71, and MCD 2) had average October flows greater an 50 gpm (Newmont, 1999b). Seasonal variations in flow occur in a number of springs, indicating shallow perched systems where flow is quickly influenced by seasonal variations in precipitation. Data from BLM files for 1982 field studies also show that the majority of springs observed in the South Operations Area were flowing at rates of less than 5 gpm.

Springs are generally classified as either thermal or non-thermal based on temperature and chemical characteristics. Thermal springs generally have higher trace metal and major ion concentrations than non-thermal springs.

Temperatures for springs of a non-thermal origin range from approximately 3 to 26°C, whereas those of thermal springs typically range from 55 to 68°C. For springs inventoried in the Maggie, Marys, and Susie Creeks Hydrographic Basins, three hot springs and one warm spring have been identified (Newmont No. 24, 40, 43, and 52). Spring 24 is located in the Susie Creek Hydrographic Basin, springs 40 and 43 are located along the Humboldt River in Marys Creek Hydrographic Basin, Spring 52 is also in Marys Creek Hydrographic Basin. Spring 52 is a warm spring with average temperatures around 20°C, and flows above 500 gpm. Spring 43 is also known as Carlin Hot Springs, and flows directly into the Humboldt River. Spring 40 is a small spring with October flow rates less than 1 gpm. Spring 24 is a series of small springs with combined flow rates of around 25 gpm. It should be noted that Spring 1 is anomalous with respect to other springs, thermal or non-thermal with elevated concentrations of major ions and trace metals. Maximum measurements at Spring 1 exceed the drinking water standards for arsenic, cadmium, chromium, iron, manganese, and lead, while minimum values were well below drinking water standards.

Maximum values of cadmium, chromium, iron and manganese levels were also exceeded in water from Spring 43 (**Table 3-14**). Spring 1 is located near the Carlin Mine in the Tuscarora Mountain Block in the Simon Creek Drainage. Nine of the surveyed sites (springs 1, 18, 21, 34, 43, 44, 50, 52, and MCD 2) were designated for water quality sampling. They included:

1. Springs that were relatively close to mining activity (1, 18, and 21);

2. Springs with significant flow (1, 18, and 21);

3. Springs that supported riparian areas (1, 18, 21, 34, 52, and MCD 2); and

4. Springs (such as thermal springs) that were believed to be fed by deep groundwater sources.

A summary of the spring water quality is presented in **Table 3-14**. In addition, as required by the Mitigation Plan (BLM, 1993), eight springs are monitored quarterly for field parameters (flow, temperature, pH, electrical conductivity, and dissolved oxygen) to establish baseline conditions. These include springs 2, 3, 14, 16, 21, 31, 34, and 57. Available data on springs and seeps in the study area can be found in the Spring Survey Gold Quarry, Fall 1998 (Newmont, 1999b). To date, no springs have been affected by dewatering from the Gold Quarry mine.

In the vicinity of the town of Carlin, two major spring complexes discharge from bedrock material and flow into the Humboldt River. The one known as Carlin Hot Spring (#43) discharges adjacent to the Humboldt River at an estimated rate of between 1 and 2 cfs and a temperature as high as 79°C (174°F) (BLM, 1993). This spring is submerged under the Humboldt River except during low-flow conditions. The second major spring near the town of Carlin, known as the Carlin "Cold" Spring complex (#60), discharges in the Marys Creek drainage near its confluence with the Humboldt River. This group of springs flows at an average rate of about 2.8 cfs. An average rate of about 1.0 cfs is diverted from this spring for municipal use at Carlin (BLM, 1993). These two spring sites are shown in **Figure 3-4**.

Surface Water Use

A listing of surface water rights was obtained from a database from the NDEP, Division of Water Resources, to provide information on location and status of water rights within four Hydrographic Basins (Maggie Creek, Marys Creek, Susie Creek, and Boulder Flat). A total of 80 surface water rights (including water rights owned by the two major mining companies, Barrick Goldstrike Mines, and Newmont Mining Corporation, and their subsidiaries), have active status in the four basin area. This includes surface water rights for which certificates, permits, and vested water rights have been awarded. An additional five water rights have been applied for. The primary uses for the water are stock watering and irrigation. A total of 23 surface water rights are in or near the hydrology study area and are shown in **Figure 3-4**. A listing of the surface water rights are available for inspection at the Nevada Division of Water Resources.

Pursuant to the Humboldt River adjudication, all surface water has been fully appropriated. The original allocation of water rights in the Humboldt River system depended on substantial contribution of return flows from irrigated lands. Currently, water is appropriated according to rate and volume. Water rights for irrigation below Palisade

TABLE 3-14
SUMMARY OF WATER QUALITY FOR JACK CREEK, SIMON CREEK, MARY'S CREEK AND SUSIE CREEK[1]

Minimum
Average
Maximum

TOTAL CONCENTRATION RANGES[1,2,3]

	Temp	pH	TDS	TSS	Turb	Ag[4]	As	Ba	Cd[4]	Cr	Fe	Hg	Mn	Pb[4]	Se
Spring 1	3.0	7.49	1100	3.6	0.3	0.005	0.011	bdl	bdl	bdl	bdl	bdl	0.056	bdl	bdl
	11.4	7.93	2441	43.9	12.7	0.008	0.037	0.07	0.013	0.015	0.33	0.0006	0.159	0.025	0.006
	17.7	8.64	3620	276.0	65.0	0.011	0.158	0.09	0.020	0.016	1.48	0.0009	0.450	0.170	0.012
Spring 18	3.4	7.50	85	bdl	0.2	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.020	bdl	bdl
	10.8	8.03	231	8.7	5.6	bdl	0.003	0.07	bdl	bdl	0.54	bdl	0.054	bdl	bdl
	17.6	8.49	361	26.0	18.0	bdl	0.009	0.08	bdl	0.008	2.96	bdl	0.140	bdl	0.002
Spring 21	7.0	7.93	120	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
	12.0	8.19	272	18.4	4.0	bdl	0.002	0.09	0.004	bdl	0.23	0.0003	0.018	0.014	0.003
	19.6	8.62	344	51.8	8.9	bdl	0.006	0.12	0.006	0.003	0.62	0.0005	0.050	0.080	0.005
Spring 34	6.5	7.30	242	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
	13.3	7.90	363	44.1	9.6	bdl	0.003	0.08	0.004	bdl	0.98	0.0003	0.222	0.012	bdl
	26.0	8.47	464	240.0	45.0	bdl	0.008	0.13	0.006	bdl	4.80	0.0005	1.200	0.080	0.001
Spring 43	17.0	6.75	280	bdl	bdl	bdl	bdl	0.11	bdl	bdl	bdl	bdl	bdl	bdl	bdl
	17.7	7.82	392	36.6	7.6	bdl	0.011	0.24	0.004	0.015	0.55	0.0002	0.088	0.008	bdl
	26.0	8.28	452	166.0	42.0	bdl	0.021	0.34	0.007	0.130	2.80	0.0003	0.530	0.020	bdl
Spring 44	3.8	7.00	311	bdl	1.0	bdl	bdl	0.06	bdl	bdl	bdl	bdl	bdl	bdl	bdl
	14.0	7.75	543	2537.2	445.9	bdl	0.008	0.06	bdl	0.010	0.49	bdl	0.380	0.009	bdl
	26.4	8.60	860	22330.0	3540.0	bdl	0.050	0.06	bdl	0.003	1.46	bdl	1.620	0.011	bdl
Spring 50	9.1	8.00	12	bdl	0.3	bdl	bdl	0.08	bdl	bdl	0.03	bdl	bdl	bdl	bdl
	13.0	8.22	319	22.6	4.8	bdl	0.002	0.09	bdl	bdl	0.18	0.0003	0.043	bdl	0.003
	20.8	8.37	454	71.6	15.2	bdl	0.007	0.09	bdl	0.005	0.46	0.0005	0.140	0.002	0.007
Spring 52	20.2	7.70	233	bdl	bdl	bdl	0.005	0.10	bdl	bdl	bdl	bdl	bdl	bdl	bdl
	21.3	8.09	281	1.8	0.3	bdl	0.008	0.10	bdl	bdl	bdl	bdl	bdl	bdl	0.002
	23.0	8.40	320	2.5	0.8	bdl	0.011	0.10	bdl	0.005	bdl	bdl	bdl	bdl	0.003
MCD 2	5.3	7.60	109	bdl	bdl	bdl	bdl	0.07	bdl	bdl	0.12	bdl	0.023	bdl	bdl
	12.9	7.99	242	21.4	2.5	bdl	0.002	0.08	bdl	bdl	0.47	0.0004	0.062	bdl	0.003
	21.2	8.20	361	100.0	9.0	bdl	0.006	0.08	bdl	bdl	0.96	0.0006	0.130	0.005	0.006
Drinking Water	---	6.5-8.5(s)	500(s)	--	--	0.05	0.05	2	0.005	0.01	0.3(s)	0	0.05(s)	0.05	0.05

1 See **Figure 3-3** for locations of springs.0.47
2 Samples collected generally quarterly from May 1991- May 1998 after which chemistry analysis was ended. Results are for unfiltered samples only. TDS = total dissolved solids; TSS = total suspended solids; Turb. = turbidity; Ag = silver; As = arsenic; **B** = barium; Cd = cadmium; Cr = chromium; Fe = iron; Hg = mercury; Mn = manganese; Pb = lead; Se = selenium;°C = degrees Celsius; SU = standard pH units (lab measured); mg/l = milligrams per liter; NTU = nepbelometric turbidity units; m = maximum; max = maximum; bdl = below detection limit.
3 All concentrations reported are primary drinking water standards unless followed by (s) indicating secondary standards.
4 High values are caused by sediment disturbed during tbe sampling process.

were awarded only for the period March 15 through September 15; water rights for irrigation above Palisade were for the period April 15 to August 15.

Groundwater Hydrology

The study area for groundwater (excluding the cumulative study area for other mines) is that portion of the Carlin Trend north of the Humboldt River in the Susie, Maggie, Marys Creeks, and Boulder Flat basins. Recharge, flow, and discharge of groundwater in the South Operations Area are influenced primarily by geologic conditions. In the South Operations Area, sedimentary deposits have primary porosity and permeability surrounding individual grains; subsequent earth movements produced secondary permeability via faults and fractures. Alteration associated with mineralization has further influenced these conditions. Subsurface geologic structures and solution cavities may act as hydraulic conduits for increased groundwater flow or as barriers to groundwater movement. Geologic structures in the study area that influence groundwater movement include the Roberts Mountain thrust fault and a number of basin-bounding, high-angle normal faults and fault zones, some with displacements of several thousand feet (Stone and Leeds, 1991).

Groundwater recharge in the project area occurs primarily through fractured bedrock in the mountains and through unconsolidated alluvium in the valleys. An annual recharge rate of 0.6 inches has been estimated for the project area (Plume and Stone, 1992). Some stream reaches also lose flow and thus recharge the shallow groundwater system.

Groundwater leaves the basin as evapotranspiration, springs and seeps, and discharge into some reaches of Maggie, Marys and Susie creeks, and the Humboldt River. Different authors estimate various groundwater flows into the Humboldt River between Carlin Tunnels and Palisade. Plume (1994) indicates an average of 51 cfs; Maurer et al. (1996) use 10 to 20 cfs. RTi (1999) shows an average of 51 cfs for the period from 1946 to 1990.

Six hydrostratigraphic units are recognized in the South Operations Area (**Table 3-15**). The shallowest unit is younger basin-fill alluvium (Quaternary age). Below the alluvium are the following hydrostratigraphic units in descending order: (1) older basin-fill sediments known as the Carlin Formation (Tertiary age); (2) volcanic rocks (Tertiary age); (3) intrusive rocks (Tertiary through Jurassic age); (4) siltstone (Paleozoic age); and (5) carbonate rocks (Paleozoic age).

Underlying these six units is Eureka Quartzite (Paleozoic age) and the Pogonip Group formations with low permeability that restricts groundwater movement. In the South Operations Area, the siltstones are structurally separated from the carbonates by thrust faults and/or normal faults.

Groundwater flow in the six hydrostratigraphic units can be generalized as three primary flow systems: (1) perched system in all units associated primarily with mountainous areas; (2) upper unconfined or water table system primarily in basin-fill sediments, siltstones, and volcanics; and (3) lower semi-confined carbonate rock system. Perched groundwater occurs where groundwater moves separately in shallow sediments and bedrock fractures, usually discharging as springs at elevations higher than the regional groundwater systems. Groundwater in the upper unconfined system generally flows within each separate drainage basin toward the basin axes and ultimately to discharge areas along the Humboldt River. In

TABLE 3-15
MAJOR HYDROSTRATIGRAPHIC UNITS IN SOAPA STUDY AREA

Hydrostratigraphic Unit	Geologic Age	Stratigraphic Unit	Unit Description
Younger basin-fill deposits	Quaternary	Alluvium	Sorted to poorly sorted deposits of stream flood plains.
Older basin-fill deposits	Tertiary	Carlin Formation	Volcaniclastic sedimentary rocks and deposits of fluvial and lacustrine origin.
Volcanic rocks	Tertiary	Volcanic Intrusives	Rhyolite and basalt flows.
Intrusive Rocks	Tertiary to Jurassic	NA	Graodiorite, quartz monzonite, diorite, monzonite.
Siltstones and shales	Devonian to Ordovician	Rodeo Creek Unit and Vinini Formation	Clastic sedimentary rocks.
Carbonate rocks	Devonian to Ordovician	Roberts Mountain and Hanson Creek Formations	Carbonate and minor clastic sedimentary rocks.

Source: Plume and Stone, 1992.

the Maggie Creek Basin Region, the groundwater generally flows to the southeast at a gradient of one percent. Flow in the deeper system in the lower semi-confined carbonate unit is not limited to a single hydrologic basin. A single extensive groundwater flow system exists, where groundwater divides typically do not coincide with topographic divides (HCI, 1999). Within the carbonate unit are local geothermal systems expressed by elevated water temperatures at various wells and hot springs. The carbonate unit is also characterized as karstic in some areas. **Table 3-16** summarizes results of aquifer tests conducted at the project area. Well locations are shown in **Figures 3-5 and 3-6.**

Alluvium. The alluvial sediments, developed along area drainages, are generally saturated. This unconsolidated unit is composed of a mixture of clays, silts, sands, and gravels and the thickness ranges from 10 up to 1,600 feet (Maurer et al., 1996). The alluvium is recharged by precipitation and snowmelt, by stream flow losses, and by discharge from the bedrock groundwater system. The surface and groundwater systems are interdependent, with groundwater contributing to stream baseflows (gaining stream) in some areas, and streams contributing to groundwater recharge (losing streams) in other areas. Seasonal variations in this interrelationship are common. Permeability of these unconsolidated sediments is highly variable.

Tertiary Sediments. Basin-fill sediments of Tertiary age are referred to as the Carlin Formation. Lithology of this unit is variable and includes siltstone, sandstone, welded tuff, mudstone, shale, conglomerate, and limestone. Thickness of these sediments ranges from a few hundred feet to more than 5,000 feet. Depth to water ranges from 25 to over 300 feet below ground surface. Permeability of these materials generally is low to moderate in this area. A thick basal layer of clay is pervasive in the Carlin Formation.

Tertiary Volcanics. The Tertiary volcanic rocks consist of rhyolite and basalt flows. Thickness of the volcanics reaches over 300 feet in the project area. Numerous fractures have made the volcanic unit very permeable.

TABLE 3-16
SUMMARY OF AQUIFER PUMPING TESTS CONDUCTED AT THE SOAPA STUDY AREA

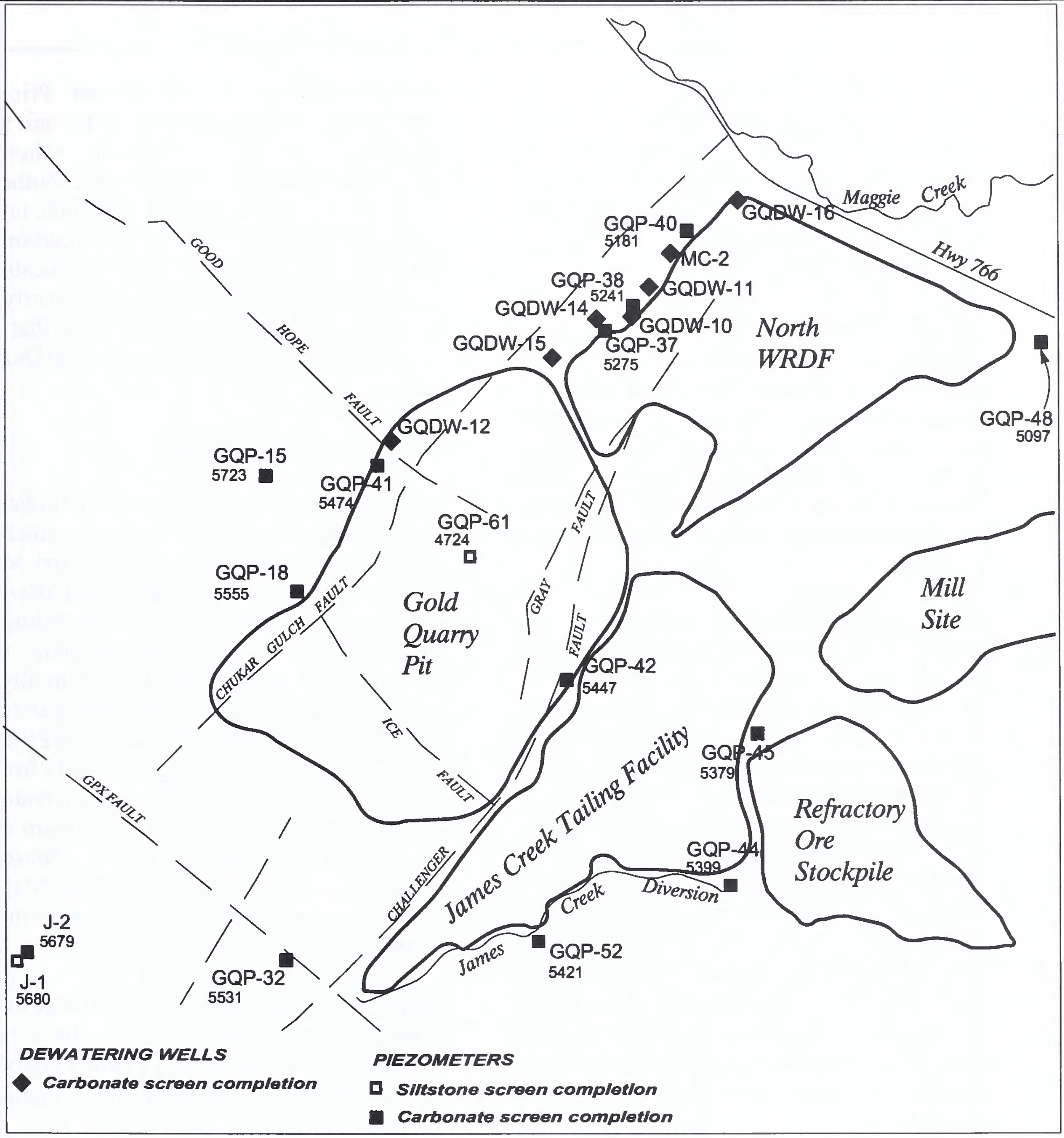
Well No.	Hydro-stratigraphic Unit	Well Depth (feet)	Pumping Rate (gpm)[1]	Pumping Period (hours)	Transmis-sivity (ft^2/day)[2]	Comments[3]
GQTW-1	Roberts Mtn Limestone	997	750	97	7,700	Gold Quarry fault zone; S = $6x10^{-3}$; K = 20 ft/day
GQTW-2	Vinini Siltstone	577	273	102	600	Unaltered siltstone; S = $9x10^{-4}$; K = 2 ft/day
GQTW-3	Paleozoic Siltstone	945	2,800	240	60,000	S = $5x10^{-3}$
GQTW-4	Paleozoic Siltstone	755	5,300	240	60,000	S = $3x10^{-3}$
GQTW-5	Paleozoic Siltstone	820	275	240	6,700	Good Hope fault zone; S = $1x10^{-3}$
GQTW-6	Roberts Mtn Limestone	1620	1400	160	70,000	S = $5x10^{-3}$; K = 23 ft/day
CBN-1	Roberts Mtn Limestone	500	480	5	>53,000	Air lift test; minimal drawdown
MC-2	Roberts Mtn Limestone	1,201	4,000	41	145,000	Fractured Gold Quarry fault zone
PW-9	Roberts Mtn Limestone	710	2,200	24	25,000	Located near well MC-2
52	Carbonate Rock	1,208	4,000	39	300,000	Fault Zone at base of Schrodeder Mountain; K = 400 ft/day
29-WW	Carlin Formation	405	220	51	1,100	S = $1x10^{-2}$; K = 1 ft/day
13a	Carlin Formation	724	1,200		870	S = $1.1x10^{-3}$; K = 2.1 ft/day
13a	Carlin Formation	724	631	10	780	K = 1.9 ft/day
13a	Carlin Formation	724	631	10	1,100-3,000	S = $1.9x10^{-3}$; K = 2.7 – 7.3 ft/day
41	Carlin Formation	755	342	24	2,500-3,600	S = $1.9x10^{-3}$; K = 4.3 – 6.3 ft/day
43	Carlin Formation	1,000	338	24	1,500	

Source: Golder Associates, Inc., 1990; Pettit et al., 1991; Pettit et al., 1992; Plume, 1994.

[1]gpm = gallons per minute. During some aquifer tests, various pumping rates were used; the average pumping rate is presented in the table. All tests are pump tests except as noted.

[2]ft^2/day = square feet per day. In some cases, several values for transmissivity (T) were determined using various observation wells and calculation methods; an approximate average value for T is presented in the table.

[3]S = storativity or storage coefficient; K = hydraulic conductivity (horizontal). In some cases, several values for storativity were determined; an approximate average value for S is presented in the table.



0 1000 2000 3000 4000

Scale in ft

Source: Newmont, 1999c

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-5
GOLD QUARRY PIT AREA GROUNDWATER MONITORING LOCATIONS AND TOP OF WELL ELEVATIONS

MINE AREA: SOUTH AREA	
DATE: 8/17/00	ACAD FILE: Fig3-5.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY DS

Three wells in the Maggie Creek Basin reportedly are completed in the volcanics. Depth to water in these wells ranges from 36 to 66 feet. The Carlin Spring probably issues from a contact between the highly permeable volcanics and a less permeable sedimentary unit (Stone and Leeds, 1991).

Intrusive Rocks. Tertiary through Jurassic intrusive rocks are a minor component of rock types in the study area and consist mostly of granodiorite, quartz monzonite, monzonite, and diorite. These rocks have relatively low hydraulic conductivity, however, wells completed in the intrusive rocks near faults may yield small quantities of water (Maurer et al., 1996).

Siltstone. Siltstone strata of Paleozoic age lies below the Tertiary deposits and has been faulted out of sequence by the Roberts Mountain thrust. This unit is assigned to the Vinini Formation and consists primarily of fine-grained clastic material with thicknesses up to several thousand feet. Groundwater is generally unconfined in this unit; however, some wells have encountered artesian or confined conditions (Stone and Leeds, 1991). Depth to water ranges from less than 100 feet to 300 feet or more. Where the siltstone is silicified and brittle, fractures have developed and provide considerable secondary permeability. The siltstone unit is exposed in most of the mountainous areas, and therefore receives recharge from precipitation and snowmelt.

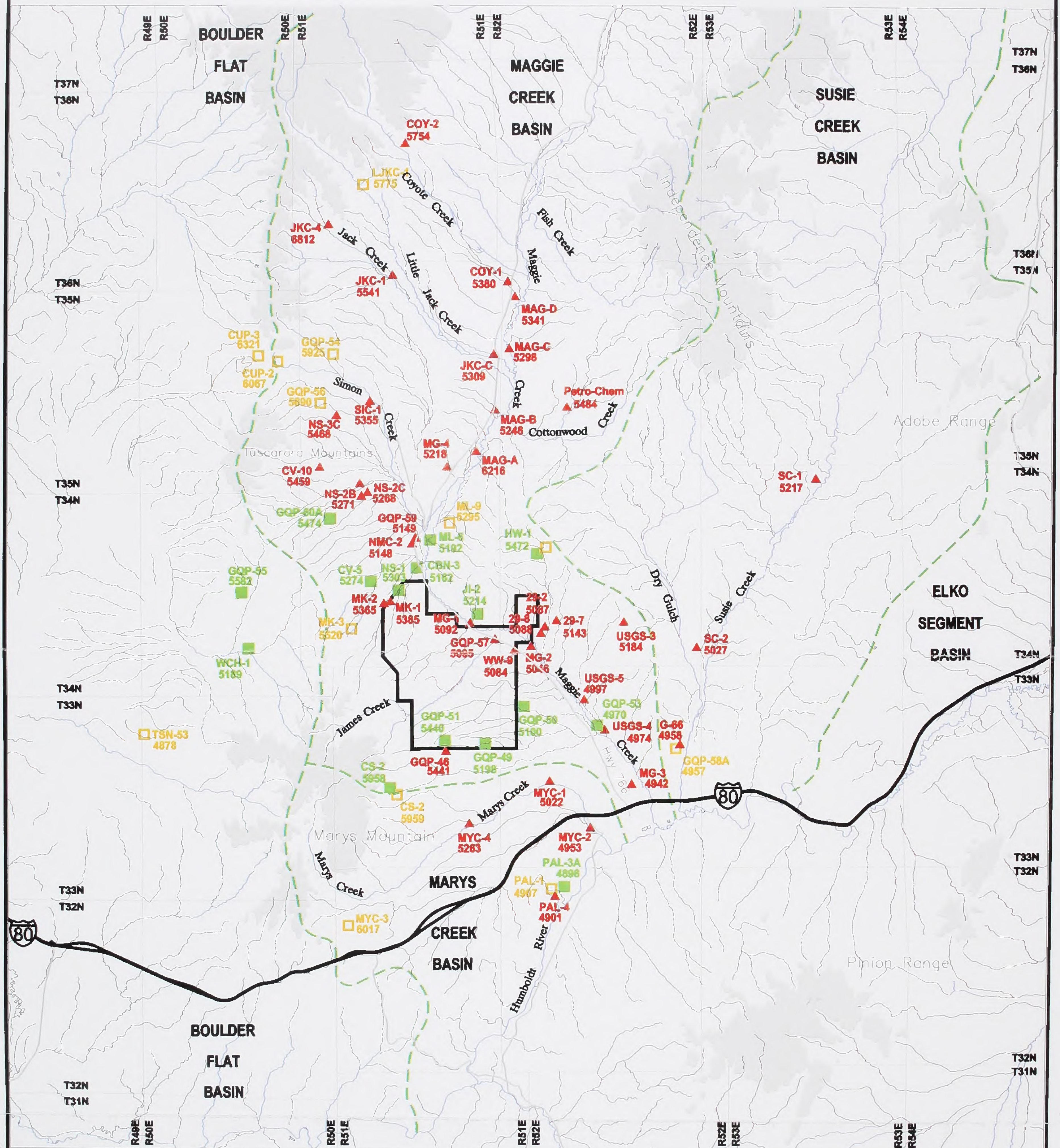
Carbonates. Approximately 3,000 feet of carbonate rock (limestone) is situated between the overlying siltstone aquifer and the underlying Eureka Quartzite confining unit that forms the effective bottom of the local groundwater flow system. Groundwater in the carbonate strata is predominantly semi-confined or confined. Depth to groundwater in wells in carbonate rock ranges from flowing artesian conditions to over 500 feet. Prior to dewatering, groundwater flow in this unit was generally to the southwest, whereas groundwater moves primarily to the southeast in the four overlying hydrostratigraphic units. High permeability is common in the carbonate rock due to fractures, faulting and localized karst conditions. The carbonate and overlying siltstone units are the primary units that are intercepted and dewatered by the Gold Quarry pit.

Groundwater Quantity

Groundwater levels are measured periodically by Newmont and the USGS in numerous wells in the vicinity of the Gold Quarry Mine (**Figures 3-5 and 3-6**). Depth to groundwater varies widely in the study area depending on the location and hydrostratigraphic unit intercepted. Some wells flow naturally at ground surface, referred to as flowing artesian wells. Seasonal variations in the water table have been observed in regional wells from a range of less than 1 foot to a maximum of approximately 20 feet in the colluvium near the Tuscarora Mountain Block. Seasonal variations in the water table along Maggie Creek average about 3 feet (Newmont, 1999b).

Water level declines of up to 600 feet in the siltstone and carbonate aquifers have been observed since 1992 near the Gold Quarry pit as a result of groundwater pumping (Newmont, 1999c). (The change from pre-mining groundwater elevation in May 1992 is illustrated in **Figure 3-7**.) Recent water table elevation contours (December 1998) in the South Operations Area are shown in **Figure 3-8**.

The groundwater levels for selected wells are shown in **Table 3-17** and locations are shown in **Figure 3-6**. Some of the wells have not



LEGEND

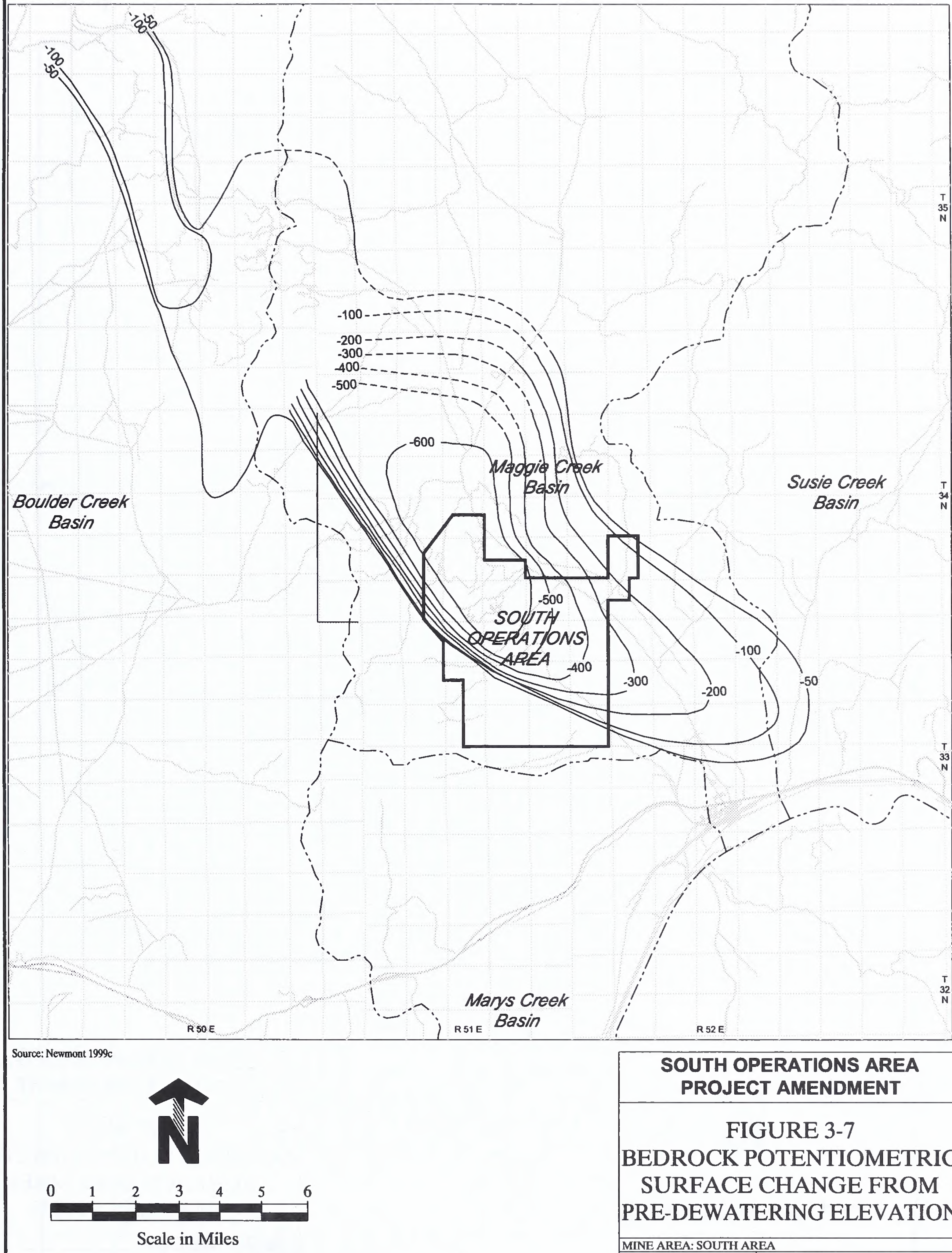
- SOAPA Boundary
- ▲ Alluvium/Colluvium/Volcanics (Tertiary)/Carlin (Tertiary) screen completion
- □ Siltstone screen completion
- ■ Carbonate screen completion

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-6
GROUNDWATER MONITORING LOCATIONS AND TOP OF WELL ELEVATIONS

MINE AREA: SOUTH AREA	
DATE: 8/18/00	ACAD FILE: Fig3-6.DWG
SCALE: AS NOTED	DRAWN BY: ML, MODIFIED BY DS

Source: Newmont, 1999c



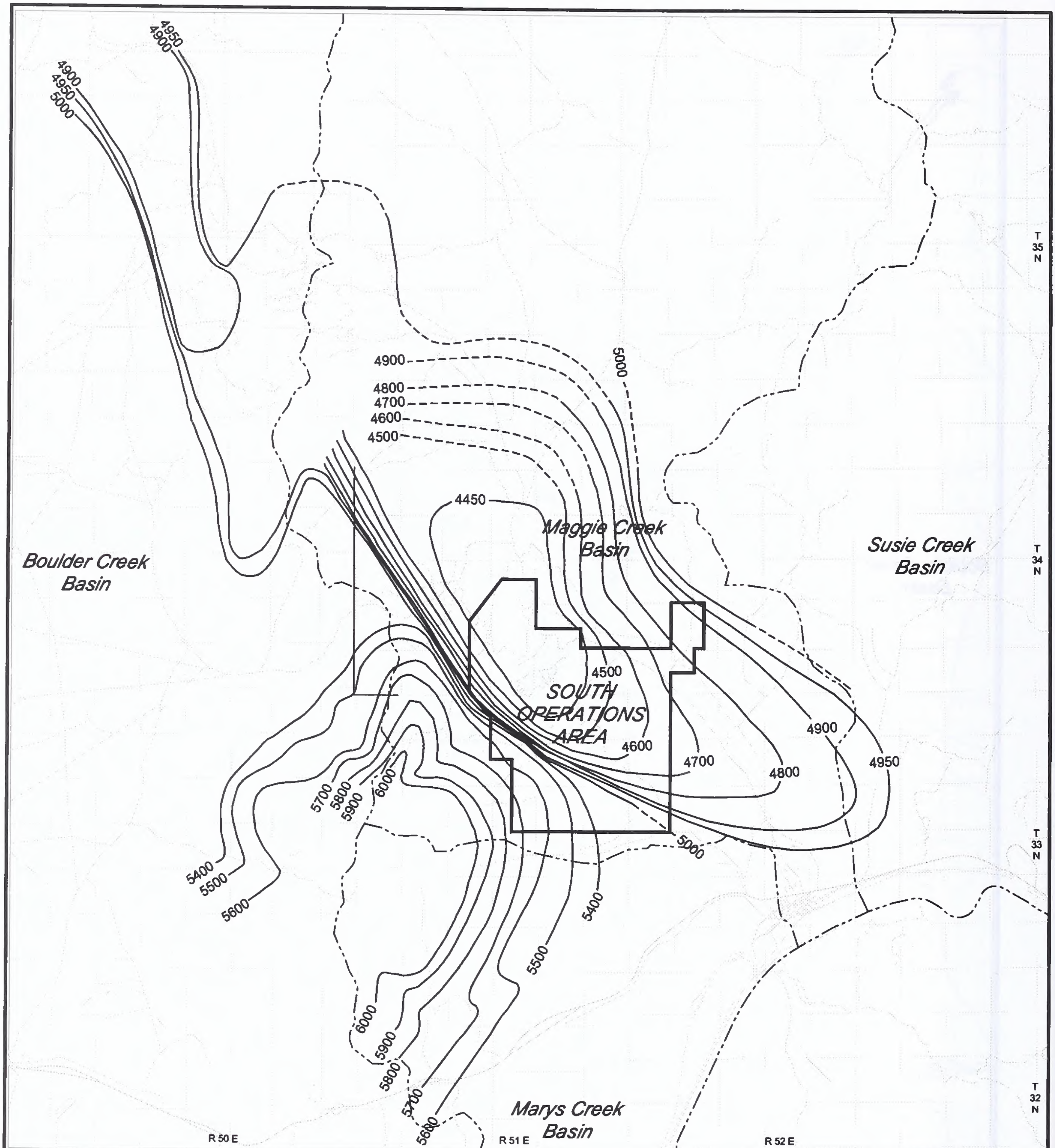
Source: Newmont 1999c

Contour interval in feet

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-7
BEDROCK POTENTIOMETRIC SURFACE CHANGE FROM PRE-DEWATERING ELEVATION

MINE AREA: SOUTH AREA	
DATE: 8/16/00	ACAD FILE: Fig3-7.dwg
SCALE: AS NOTED	DRAWN BY: ML, MODIFIED BY DS



N

0 1 2 3 4 5 6

Scale in Miles

Contour interval in feet

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-8
BEDROCK POTENTIOMETRIC SURFACE DECEMBER 1998 ELEVATION

MINE AREA: SOUTH AREA	
DATE: 8/16/00	ACAD FILE: Fig3-8.dwg
SCALE: AS NOTED	DRAWN BY: ML, MODIFIED BY DS

TABLE 3-17
Summary of Groundwater Levels in Selected Wells in the South Operations Study Area[1]

Well	Screened Formation	Ground Elevation ft(msl)	Minimum Water Level ft(msl)	Month/ Year	Maximum Water Level ft(msl)	Month/ Year	Range of Water Level ft	Period of Record
JKC-1	Alluvium	5541	5506	Jul-96	5531	Apr-96	26	Dec-91 - Dec-98
JKC-2	Alluvium	5543	5516	Oct-92	5530	Apr-96	13	Dec-91 - Dec-98
MYC-2	Tertiary Volcanics	4953	4928	Jul-92	4936	Jun-98	8	Aug-91 - Dec-98
SIC-1	Carlin Formation	5355	5298	Sep-94	5302	Sep-98	5	Dec-91 - Dec-98
NMC-2	Carlin Formation	5148	5151	Sep-98	5159	Apr-93	8	Sep-92 - Dec-98
29-7	Carlin Formation	5149	5004	Jan-93	5038	Nov-98	34	Jun-92 - Dec-98
29-8	Carlin Formation	5086	5017	Jul-92	5058	Nov-98	42	Jun-92 - Dec-98
MYC-1	Carlin Formation	5022	4919	Jun-92	4928	Jul-96	9	Aug-91 - Dec-98
LJKC-1	Siltstone	5775	5781	Sep-96	5788	Jun-92	8	Jun-92 - Dec-98
MC-2	Limestone	5196	4404	Dec-98	4889	May-94	486	May-94 - Dec-98
CS-2	Limestone	5958	5989	Oct-92	6024	Jun-92	36	Jun-91 - Dec-98
GQP-15	Limestone	5726	4416	Dec-98	5028	May-92[2]	612	May-92 - Dec-98
GQP-37	Limestone	5277	4377	Nov-98	5031	May-92[2]	654	May-92 - Dec-98

Source: Newmont, 1999c.

[1] Water Levels were generally measured monthly.

[2] Estimate.

TABLE 3-18
WATER PRODUCTION AND USE 1994 - 1998

Million Gallons	1994	1995	1996	1997	1998
Total Production	7325.17	7980.45	8290.33	9093.29	8749.94
(acre-feet per year)	22,470	24,493	25,444	27,910	26,850
Discharge	2880.47	5195.36	4876.20	6186.80	6017.46
Irrigation	1632.21	612.18	873.76	951.38	1024.37
Mining & Milling	1638.21	2264.15	1584.14	1416.10	1181.05
Storage[1]	1174.28	-91.24	81.47	-154.64	-29.32
Miscellaneous			874.76	693.65	556.38

Source: Newmont, 1999c.
[1] Negative storage equals discharge from storage.

been noticeably affected by the mine pumping, and maximum and minimum water levels span a range of less than 12 feet (MYC-2, SIC-1, NMC-2, MYC-1, LJKC-1).

The total water production of the Gold Quarry pit increased from 22,470 acre-feet per year in 1994 to 27,910 acre-feet per year in 1997 and fell to 26,850 acre-feet per year in 1998 (**Table 3-18**). All pumping occurred in perimeter carbonate wells in Chukar Gulch.

Some mine water was temporarily stored in Maggie Creek Ranch Reservoir. The largest part of the pumped water is discharged into Maggie Creek, less than 30 percent is used for mining and milling activities, and a smaller percentage is used for seasonal irrigation.

Groundwater Quality

Groundwater quality for selected parameters in the study area is summarized in **Table 3-19**. Groundwater quality is influenced by geology, flow paths, residence time, and, in some cases, human factors. In general, water quality from all five major hydrostratigraphic units is similar; however, concentrations of ions are higher in the deeper units because of longer residence times. Groundwater from all hydrostratigraphic units is of the calcium-carbonate or sodium-carbonate type. Typical concentration ranges for selected chemical parameters are as follows: specific conductance = 100 to 700 μmhos/cm; total dissolved solids = 200 to 400 mg/L; pH = 6.5 to 8.5; dissolved oxygen = 2.5 to 6.0 mg/L; and temperature = 11 to 19°C (deeper units = 23 to 33°C).

Quality of groundwater to be pumped from the South Operations Area has been characterized by wells completed in the carbonate unit. Hardness of deeper groundwater is approximately 250 mg/L and total dissolved solids ranges from about 270 to 480 mg/L.

Deep water temperature ranges from 12°C to 34°C and pH ranges from 6.8 to 8.4. Geothermal gradients observed in some South Operations Area wells range from 0.6 to 4°C per 100 feet (Stone and Leeds, 1991). Groundwater parameters in the carbonate rock that have exceeded drinking water standards include arsenic, iron, and manganese (**Table 3-19**). Manganese and iron are the metals that most often exceeded drinking water standards in groundwater. Highest concentrations of arsenic are found in well SIC-1 in the Carlin Formation, with a total concentration of 0.11

TABLE 3-19
SUMMARY OF GROUNDWATER QUALITY IN THE SOAPA STUDY AREA

Minimum
Average
Maximum

TOTAL CONCENTRATION RANGES [1,2,3]

Station	Temp	pH	Hard	TDS	Turb	Ag	As	Ba	Cd	Cr	Fe	Hg	Mn	Pb	Se	Zn
JKC-1	9.7	8.88	260	210	0.7	bdl	bdl	0.27	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
(1992-1996)	13.8	11.44	630	808	9.2	bdl	bdl	0.61	bdl	0.009	0.06	bdl	0.012	bdl	bdl	0.013
	17.2	12.36	1300	2082	30.0	bdl	bdl	1.20	bdl	0.012	0.33	bdl	0.074	bdl	bdl	0.060
JKC-2	10.1	7.68		194	38.0		0.016			bdl	5.65		1.570	bdl	bdl	bdl
(1996-1998)	12.2	7.89		226	41.2		0.017			bdl	5.89		1.635	bdl	bdl	0.017
	15.8	7.97		262	46.0		0.018			bdl	6.14		1.740	bdl	bdl	0.040
MYC-2	13.8	6.52	87	149	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
(1992-1998)	15.8	7.82	106	195	0.3	bdl	0.008	0.08	bdl	0.007	0.02	0.0002	0.003	bdl	bdl	0.006
	18.5	8.30	150	290	0.8	bdl	0.012	0.17	bdl	0.006	0.14	0.0002	0.007	bdl	bdl	0.014
SIC-1	10.8	6.43	140	208	1.5	bdl	bdl	0.11	bdl	bdl	0.27	bdl	1.110	bdl	bdl	bdl
(1992-1998)	13.1	7.68	146	258	22.0	bdl	0.044	0.21	bdl	0.012	2.09	0.0005	1.260	0.007	bdl	0.012
	16.0	8.35	160	290	200.0	bdl	0.110	0.37	bdl	0.058	15.00	0.0011	1.500	0.019	bdl	0.090
NMC-2	21.9	6.76	33	208	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
(1992-1998)	30.7	8.03	37	237	0.5	bdl	0.020	0.09	bdl	0.007	0.11	0.0003	0.034	0.119	bdl	0.010
	36.8	8.47	46	266	1.6	bdl	0.032	0.116	bdl	0.009	0.20	0.0008	0.092	0.004	bdl	0.070
29-7	15.1	6.58	190	300	0.2	bdl	bdl	0.09	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
(1992-1998)	17.3	7.87	194	339	1.1	bdl	0.006	0.10	bdl	0.006	0.04	0.0002	0.003	0.004	0.002	0.012
	19.6	8.38	200	380	11.0	bdl	0.009	0.10	bdl	0.005	0.30	0.0009	0.010	0.002	0.001	0.100
29-8	11.1	6.76	150	320	bdl	bdl	0.009	0.15	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
(1992-1998)	14.7	7.88	186	442	0.4	bdl	0.015	0.29	bdl	bdl	0.02	bdl	0.004	bdl	0.003	0.010
	17.6	8.45	200	835	2.4	bdl	0.022	0.59	bdl	bdl	0.04	bdl	0.022	bdl	0.008	0.060
MYC-1	10.3	6.30	150	149	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
(1992-1998)	14.3	7.84	150	218	0.4	bdl	0.002	0.07	bdl	bdl	0.02	0.0001	0.003	bdl	0.002	0.005
	18.6	8.43	150	264	1.3	bdl	0.005	0.08	bdl	bdl	0.04	0.0001	bdl	bdl	0.002	0.011
PW-4	11.8	6.73	88	210	bdl	bdl	0.006	0.05	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
(1992-1997)	17.5	7.78	137	268	1.7	bdl	0.011	0.15	bdl	0.007	0.47	0.0002	0.008	0.008	0.002	0.020
	25.2	8.42	160	304	18.5	bdl	0.021	0.19	bdl	0.005	3.50	0.0001	0.070	0.019	0.002	0.117
LJKC-1	10.8	6.73	320	402	5.5	bdl	bdl	bdl	bdl	bdl	0.47	bdl	0.039	bdl	bdl	bdl
(1992-1998)	13.8	11.97	328	450	13.9	bdl	0.004	bdl	bdl	bdl	1.13	bdl	0.050	bdl	bdl	0.006
	16.0	8.32	340	480	28.0	bdl	0.009	bdl	bdl	bdl	2.23	bdl	0.077	bdl	bdl	0.020

TABLE 3-19 (continued)
SUMMARY OF GROUNDWATER QUALITY IN THE SOAPA STUDY AREA

Minimum
Average
Maximum

TOTAL CONCENTRATION RANGES [1,2,3]

Station	Temp	pH	Hard	TDS	Turb	Ag	As	Ba	Cd	Cr	Fe	Hg	Mn	Pb	Se	Zn
GQDW-10	29.0	7.86		321	bdl		0.020			bdl	bdl		bdl	bdl	bdl	bdl
(1995-1998)	30.3	7.86		363	0.6		0.023			bdl	0.12		bdl	0.004	bdl	0.025
	33.0	8.31		417	2.2		0.030			bdl	0.47		bdl	0.008	bdl	0.048
GQDW-11	29.3	8.05		313	bdl		0.014			bdl	bdl		bdl	bdl	bdl	bdl
(1995-1998)	30.8	8.21		360	0.4		0.020			bdl	0.04		bdl	bdl	bdl	0.031
	33.6	8.39		408	2.2		0.026			bdl	0.18		bdl	bdl	bdl	0.078
GQDW-12	26.5	7.91		272	0.2		0.019			bdl	bdl		bdl	bdl	bdl	bdl
(1995-1998)	28.6	8.16		329	0.7		0.028			bdl	0.05		0.005	0.003	bdl	0.038
	31.0	8.42		383	2.3		0.040			bdl	0.34		0.035	0.007	bdl	0.065
GQDW-13	19.9	7.62		326	6.5		0.014	bdl	bdl	bdl	1.40	bdl	0.058	bdl	bdl	bdl
(1996)	21.9	8.05		398	6.5		0.024	bdl	bdl	bdl	1.85	bdl	0.113	bdl	bdl	0.015
	23.3	8.41		477	6.5		0.041	bdl	bdl	bdl	2.68	bdl	0.190	bdl	bdl	0.040
GQDW-14	29.8	6.77		322	bdl		0.015			bdl	bdl		bdl	bdl	bdl	0.010
(1996-1998)	31.6	7.96		362	0.6		0.020			bdl	0.04		0.009	bdl	bdl	0.019
	33.2	8.37		404	2.2		0.023			bdl	0.11		0.057	bdl	bdl	0.027
GQDW-15	29.1	7.93		313	0.2		0.015	0.12	0.005	bdl	bdl	0.0010	bdl	bdl	bdl	0.012
(1996-1998)	31.5	8.05		346	0.5		0.019	0.12	0.005	0.008	0.07	0.0010	0.005	0.003	0.003	0.021
	34.2	8.17		393	2.2		0.024	0.12	0.005	0.050	0.14	0.0010	0.020	0.005	0.006	0.050
MC-2	27	6.80	220	330	bdl	bdl	0.014	0.08	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
(1992-1998)	30.4	7.97	230	371	2.3	bdl	0.024	0.10	bdl	0.006	0.29	0.0004	0.004	bdl	bdl	0.018
	33.1	8.36	240	432	20.0	bdl	0.078	0.11	bdl	0.005	3.50	0.0017	0.023	bdl	bdl	0.050
CS-2	12.3	6.83	280	290	8.3	bdl	bdl	bdl	bdl	bdl	1.10	bdl	0.120	bdl	bdl	bdl
(1992-1998)	15.6	7.77	305	349	31.1	bdl	0.002	bdl	bdl	0.007	3.46	0.0001	0.147	bdl	bdl	0.006
	18.1	8.28	320	384	79.0	bdl	0.004	bdl	bdl	0.006	8.99	0.0001	0.190	bdl	bdl	0.012

Source: Newmont, 1999c.

[1] Mean values were calculated assuming half detection limit for values below detection limit.

[2] Samples were collected generally quarterly from 1992-1998. Concentrations for parameters are total; Hard = hardness; TDS = total dissolved solids; Turb. = turbidity; Ag = silver; As = Arsenic; Ba = barium; Cd = cadmium; Cr = chromium; Fe = iron; Hg = mercury; Mn = manganese; N = nickel; Pb = lead; Se = selenium; Zn = zinc; °C = degrees Celsius; SU = standard pH units (lab measured); mg/L = milligrams per liter; NTU = nephelometric turbidity units; min = minimum; max = maximum; bdl = below detection limit.

[3] All concentrations reported are primary drinking water standards (see Table 3-14).

mg/L. Groundwater quality may not be lowered below state or federal regulations prescribing standards for drinking water (NAC 445A.424). Limitations on degradation of water for mining operations are described in NAC 445A.424.

Groundwater Use

A total of 174 ground water rights and 41 applications for water rights (including those by the two major mining companies, Barrick Goldstrike Mines, and Newmont Mining Corporation, and their subsidiaries), are listed for the four basin area considered for this study (including cumulative impact analysis area). These 174 groundwater rights include vested groundwater rights and groundwater rights under permits and certificates, as well as five non-permitted single family wells. Single family domestic wells do not need a permit, but must submit a well log. The five listed non-permitted wells are located close to the South Operation Area. The primary uses for the water of all wells are stock watering and irrigation. A list of ground water rights is available for inspection at the BLM Elko Field Office. Water rights issued for each use category are summarized below.

Irrigation and Stock. The four basin area contains 134 wells permitted for irrigation and stock use.

Municipal. The four basin area contains four wells permitted for municipal use; these wells are owned by the city of Carlin. All wells with municipal water rights are located near the mouths of Marys Creek and Maggie Creek. Additionally there are 6 wells for quasi-municipal purposes (e.g., for the prison department and transportation department).

Domestic. With few exceptions, a water right is not required to produce from a domestic well in Nevada. Several domestic wells were clustered in Section 9, T33N, R52E, approximately 2 miles east of the South Operations Area. These domestic wells were installed in a subdivision development (Goldview Estates) that has subsequently been acquired by Newmont (with one private parcel exception). Wells in the subdivision are screened in the range of 107 to 150 feet below ground surface and are no longer used for domestic purposes. Two additional domestic wells are located just west of Goldview Estates and are also owned by Newmont.

Industrial and Commercial. The four basin area also contains 16 wells permitted for industrial, commercial, environmental, and other purposes.

Mining/Milling and Construction. A total of 11 wells (excluding water rights owned by the two major mining companies) are permitted for mining and milling in the four basin area.

Hydrologic Monitoring Program

Newmont collects hydrologic information in the vicinity of the South Operations Area on a periodic basis as part of its ongoing monitoring program. Results of groundwater and surface water monitoring are submitted to the NDWR, NDEP, USGS and BLM. The Maggie Creek Basin Monitoring Plan was prepared to provide a method of evaluating potential impacts of mine activities and dewatering. Additional requirements for monitoring are outlined in the 1993 EIS (BLM, 1993). Hydrologic monitoring has established baseline data and reports evolving conditions for both groundwater levels and quality and surface water flow and quality. Data collected by Newmont are supplemented by USGS information collected at surface

water stations and groundwater monitoring wells.

Spring and seep surveys were initiated by Newmont in the fall of 1990. Sixty-two springs are currently monitored according to various schedules (Newmont, 1999b). Flow rates, pH, temperature, specific conductance, and dissolved oxygen are measured. Eight springs are monitored quarterly, 25 springs are sampled semi-annually, and an additional 37 springs are voluntarily monitored annually, typically in October. A summary of water quality of selected springs is shown in **Table 3-14**.

Surface water monitoring involves 29 stations on 12 streams and the Humboldt River. Discharge is measured using eight continuous recorders on Simon Creek, Maggie Creek, Marys Creek, Susie Creek, and the Humboldt River. Maggie Creek has three and the Humboldt River has two USGS surface water stations in the study area. On the remaining stations, point discharge measurements are taken monthly (**Figure 3-2**).

The USGS collects some of the hydrologic information outlined above as well as additional surface water and groundwater data in the project area. This information is presented annually in the USGS Water Resources Data reports for Nevada (for an example, see USGS, 1998). Hydrologic monitoring by Newmont will continue for a period of time to be established by an agreement between BLM and Newmont.

FLOODPLAINS

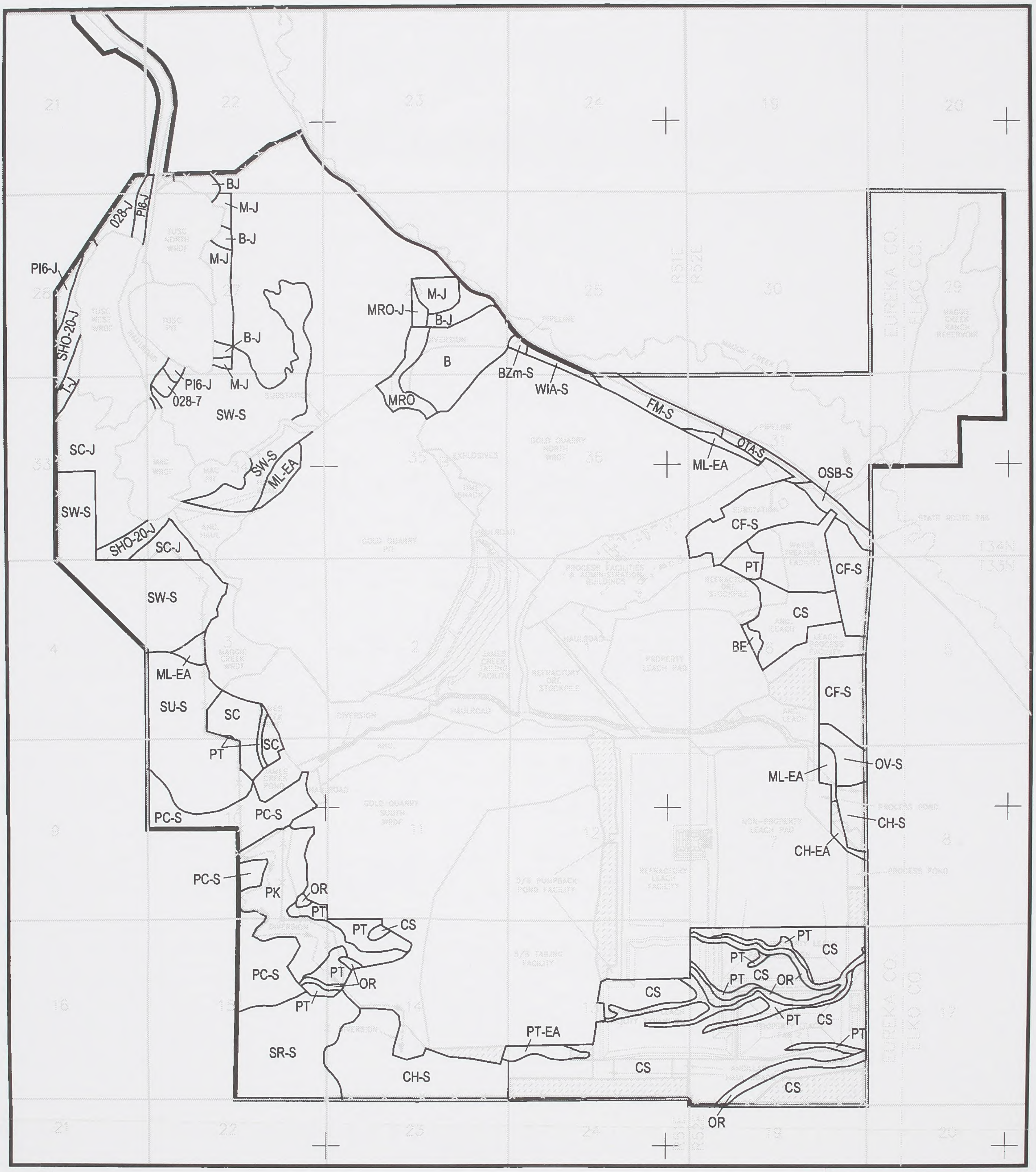
Federal Emergency Management Agency flood insurance maps delineating the 100-year floodplain have been prepared for the Humboldt River in the vicinity of Carlin (Federal Emergency Management Agency, 1984 and 1990). These maps show the Humboldt River has a floodplain ranging from 0.25 to 1.5 miles wide. The maps indicate that channel changes have occurred frequently and at different degrees at different locations. Ninety four water wells are currently monitored by Newmont for water levels and/or water quality (**Table 3-20** and **Figure 3-6**). Water levels are monitored monthly, and water quality samples are taken annually (formerly quarterly). In addition, production wells are sampled quarterly for total dissolved solids and arsenic. Flows have cut across meanders, eroded banks, and have the ability to scour and create bars and terraces. In some places, agriculture is practiced in the floodplain.

SOILS

The study area for soils comprised the undisturbed areas within the proposed SOAPA boundary of the South Operations Area Project. Soils within the study area have developed on lower mountain slopes and desert basin landforms including alluvial fans and terraces. Soils of the currently permitted South Operations Area were described in the previous EIS (BLM, 1993).

A composite of all soils mapping for the project area was included in a 1992 soils technical report (Westech, 1992). **Figure 3-9** indicates Order II soil mapping units for previously undisturbed portions of the study area. This map is based on previous soils mapping for the area, aerial photo interpretation, and field checking in September 1997.

Soil classifications for the study area indicate diversity in soil development as well as limitations to plant growth. Limiting factors



LEGEND

PLAN OF OPERATIONS BOUNDARY

FACILITY BOUNDARY

SECTION LINE

TOPSOIL STOCKPILE

DIVERSION DITCHES

PERIMETER FENCES

ANC. = ANCILLARY DISTURBANCE

WRDF = WASTE ROCK DISPOSAL FACILITY

0 1/4 1/2 3/4 1

Scale in Miles

Soil Mapping Units by Source

I Soil mapping units in new areas to be disturbed under the South Operations Area Project Amendment:

BU	Bucan, 15-30% slopes
BE	Berning, 30-75% slopes
CS	Cherry Spring, 2-8% slopes
MR	Malpais-Rock Outcrop, 50-75% slopes
OR	Orovada, 4-15% slopes
PK	Pie Creek, 15-30% slopes
PT	Puett, 15-30% slopes
SC	Susie Creek, 4-15% slopes

II Soil mapping units delineated in the Newmont Inventory Soils and Vegetation Report or the Newmont Inventory Addendum Report (JBR 1992a and 1992b):

B-J	Bucan, 15-30% slopes
M-J	Malpais, 50-75% slopes
MRO-J	Malpais-Rock Outcrop, 50-75% slopes
O28-J	O28-J Orovada, 4-15% slopes
P16-J	Puett, 4-75% slopes
SC-J	Susie Creek, 4-15% slopes
SHO-20-J	Short Creek, 30-75% slopes
T-J	Toeja, 4-30% slopes

III Soil mapping units delineated in the USDI, Bureau of Land Management, Environmental Assessment, Gold Quarry Mill 2/5 Tailing Facility Report (BLM 1991):

CH-EA	Cherry Spring, 2-8% slopes
ML-EA	Mine-Related Disturbed Land
PT-EA	Puett, 15-30% slopes

IV Soil mapping units delineated in the USDA, Soil Conservation Service, Soil Survey of the Tuscarora Mountain Area, Nevada (USDA 1980):

BZm-S	Bucan-Malpais, 15-75% slopes
CF-S	Berning-Cherry Spring, 2-30% slopes
CH-S	Cherry Spring-Cortez-Tomera, 2-8% slopes
FM-S	Four Star, 0-2% slopes
OSB-S	Orovada, 2-4% slopes
OTA-S	Orovada, 0-20% slopes
OV-S	Orovada, 4-30% slopes
PC-S	Pie Creek-Susie Creek-Toeja, 4-30% slopes
SR-S	Stampede-Donna, 2-15% slopes
SU-S	Susie Creek-Pattani, 4-15% slopes
SW-S	Susie Creek-Short Creek-Toeja, 4-50% slopes
WIA-S	Wholan, 0-2% slopes

N

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-9
SOIL MAPPING UNITS

MINE AREA: SOUTH AREA	
DATE: 6/6/00	ACAD FILE: Fig3-9.DWG
SCALE: 1"=3000'	DRAWN BY: ML, MODIFIED BY: WM

TABLE 3-20
SOAPA STUDY AREA MONITOR WELLS[1]

WELL ID	SCREEN INTERVAL feet	TOTAL DEPTH feet	MONITORING WATER LEVEL	MONITORING WATER QUALITY
Pit Area Monitor Wells				
SILTSTONE				
GQP-61	360-400	400	X	
J-1	440-460	500	X	
LIMESTONE				
GQDW-10	514-1274	1325		X
GQDW-11	588-1284	1325		X
GQDW-12	716-1556	1610		X
GQDW-13	970-1650	1670		X
GQDW-14	660-1380	1400		X
GQDW-15	708-1548	1550		X
GQDW-16	640-1400	1500		X
GQP-15	1580-1600	1600	X	
GQP-18	1580-1600	1600	X	
GQP-32	440-460	460	X	
GQP-32A	979-999	1000	X	
GQP-37	1158-1178	1178	X	
GQP-38	927-947	950	X	
GQP-40	1140-1160	1200	X	
GQP-41	1165-1185	1200	X	
GQP-42	2797-2817	2817	X	
GQP-44	1580-1600	1600	X	
GQP-45	1564-1584	1585	X	
GQP-48	1679-1699	1700	X	
GQP-52	1470-1490	1498	X	
J-2D	700-720	735	X	
MC-2	1041-1201	1208	X	X
CARLIN FORMATION				
GQP-57	640-660	660	X	
Regional Monitor Wells				
SILTSTONE				
CS-1	280-300	320	X	
CUP-2	390-410	425	X	
CUP-3	380-400	405	X	
GQP-58A	1355-1375	1380	X	
HW-1S	1120-1140	1755	X	
LJKC-1	440-500	500	X	X
MK-3	183-203	203	X	
ML-9	1579-1599	1600	X	
MYC-3	1013-1033	1035	X	
PAL-1	278-298	300	X	
TSN-53	525-545	820	X	
WCH-1	570-590	600	X	

TABLE 3-20 (continued)
SOAPA STUDY AREA MONITOR WELLS[1]

WELL ID	SCREEN INTERVAL feet	TOTAL DEPTH feet	MONITORING WATER LEVEL	MONITORING WATER QUALITY
LIMESTONE				
CBN-3	575-580	580	X	
CS-2	425-625	625	X	X
CV-5	2730-2750	2750	X	
GQP-50	1278-1298	1300	X	
GQP-51	1179-1199	1200	X	
GQP-60A	2476-2496	2500	X	
HW-1D	1735-1755	1755	X	
ML-6	2484-2504	2505	X	
NS-1	521-821	841	X	
PAL-3A	980-990	1000	X	
GQP-49	1849-1869	1870	X	
GQP-53	2270-2290	2300	X	
GQP-54	1680-1700	1823	X	
GQP-55	1230-1250	1670	X	
GQP-56	980-1020	1020	X	
CARLIN FORMATION				
29-2	130-140	142	X	
29-7	165-184	185	X	X
29-8	69-89	90	X	X
G-66	65-145	145	X	
GQP-57	640-660	660	X	
MK-1	476-505	505	X	
MK-2	180-200	200	X	
MYC-1	655-675	675	X	X
MYC-4	250-270	270	X	
NMC-2	178-958	1000	X	X
NS-2A	980-100	1000	X	
NS-2B	560-580	580	X	
NS-2C	440-460	463	X	
PETRO-CHEM	75-175	187	X	
PW-4	140-520	540		X
SC-2	80-100	100	X	
SIC-1	170-180	230	X	X
WW-9	50-700	700	X	
TERTIARY VOLCANICS				
GQP-46	380-400	400	X	
MYC-2	74-84	85	X	X
SC-1	120-140	140	X	
USGS-3	278-298	305	X	
USGS-4	77-97	105	X	
USGS-5	152-172	175	X	
ALLUVIUM/COLLUVIUM				
COY-1	95-110	110	X	
COY-2	45-50	50	X	

TABLE 3-20 (continued)
SOAPA STUDY AREA MONITOR WELLS[1]

WELL ID	SCREEN INTERVAL feet	TOTAL DEPTH feet	MONITORING	
			WATER LEVEL	WATER QUALITY
CV-10	1415-1435	1435	X	
GQP-59	55-65	65	X	
JKC-1	308-318	320	X	
JKC-2	48-58	60	X	X
JKC-3	35-40	40	X	
JKC-4	65-70	70	X	
MAG-A	35-40	40	X	
MAG-B	25-30	30	X	
MAG-C	25-30	30	X	
MAG-D	25-30	30	X	
MG-1	63-68	70	X	
MG-2	69-75	75	X	
MG-3	58-63	65	X	
MG-4	63-68	105	X	
NS-3C	500-520	525	X	
PAL-4	72-82	82	X	

Source: Newmont, 1999c.
[1]See **Figure 3-6** for locations of wells.

affecting usefulness of salvaged soils for reclamation include salts, coarse fragments, texture, depth to bedrock, steepness of slopes, and presence of a clay pan or cemented horizon. Flooding frequency and shallow depth to water table do not appear to be limiting factors for study area soils. **Table 3-21** lists the eight soil mapping units identified within previously undisturbed portions of the amendment area. Soil salvage depths listed for each mapping unit are based on previous baseline reports, 1997 field observations, and Table 620-11 in the National Soil Survey Handbook (USDA-SCS, 1993).

Six of the eight soil mapping units have been found suitable for reclamation and salvageable to depths estimated to range from six to 24 inches **(Table 3-21)**. Two soil mapping units are unsuitable because of excessive stoniness within the profile and their presence on slopes which are too steep for effective salvage.

The Carlin Formation material being mined from the pit can serve as supplemental growth medium during reclamation. While Newmont is not currently stockpiling this material, they plan to create a stockpile for the closure and reclamation of the Refractory Leach Facility.

VEGETATION

The study area for vegetation is the same as described in the original EIS (BLM, 1993) and includes the amendment area. The vegetative landscape in the vicinity of the Carlin Trend is characterized by sagebrush steppe and a scattering of riparian communities bordering drainages, springs and seeps. BLM Standard Ecological Site Description methods, which use soils information in addition to plant species composition, have been used to describe the vegetation in terms of ecological range sites (JBR, 1992c). Nine range site types were identified within the study area (BLM, 1993) which is defined as an area of

TABLE 3-21
SOIL MAPPING UNITS WITHIN THE SOAPA AREA

Map Symbol	Mapping Unit	Parent Material	Landscape Position	Salvage Depth[1]
BU	Bucan, 15-30% slopes	Loess high in volcanic ash over residuum from volcanic rock	hilly uplands	18
BE	Berning, 30-75% slopes	Alluvium from mixed rock sources	terrace breaks	0[2]
CS	Cherry Spring, 2-8% slopes	Loess high in volcanic ash over mixed alluvium	dissected low terraces	24
MR	Malpais-Rock Outcrop, 50-75% slopes	Colluvium from volcanic rock	canyon walls and rock outcrops	0[2]
OR	Orovada, 4-15% slopes	Loess high in volcanic ash, alluvium from mixed rock sources	lower parts of fans and terraces	18
PK	Pie Creek, 15-30% slopes	Residuum from tuff, tufaceous sandstone and mixed rocks, volcanic ash and loess	side slopes of upland hills	6
PT	Puett, 15-30% slopes	Residuum from tuff, tufaceous sandstone and mixed rocks, volcanic ash and loess	upper parts of upper alluvial terraces and slopes	12
SC	Susie Creek, 4-15% slopes	Residuum from tuff, tufaceous sandstone and mixed rocks, volcanic ash and loess	uplands	18

[1] Based on previous soil surveys and sampling/field observations, September 1997.
[2] Too steep and stony to salvage.

11,636 acres in parts of 20 sections comprising the South Operations Area. Their mapped extent, and detailed descriptions of each are provided in the original EIS (BLM, 1993).

Of the nine range site types identified within the study area, two types, loamy 8-10 inch precipitation zone and loamy 10-12 inch precipitation zone, accounted for 80 percent of the 11,636 acre area (BLM, 1993) (**Table 3-22**).

Vegetation cover on the loamy 10-12 inch precipitation zone was dominated by shrubs (22 percent), including basin sagebrush, Wyoming big sagebrush and mountain sagebrush and Douglas rabbitbrush. Sandberg bluegrass, bottlebrush squirreltail, Great Basin wildrye, and bluebunch wheatgrass were also common. The loamy 8-10 inch precipitation plan to create a stockpile for the closure/ reclamation of the Refractory Leach Facility. zone range type exhibited a slightly smaller proportion (18 percent) of shrubs. Here, Wyoming big sagebrush was codominant with Sandberg bluegrass, bottlebrush squirreltail, Thurber needlegrass, and bluebunch wheatgrass.

Of the 11,636 acres within the study area, 7,960 acres are areas that either have existing disturbance or are approved for disturbance. The remaining 3,676 acres (32 percent) of the surveyed area is undisturbed. For SOAPA, 1,392 acres of new disturbance is proposed. A summary of the range sites is provided in **Table 3-23**.

TABLE 3-22
RANGE SITES WITHIN THE SOAPA STUDY AREA

Range Site	Percent
loamy 8-10	59
loamy 10-12	21
chalky knoll	5
dry floodplain	<1
south slope	3
churning clay	3
shallow loam	<1
claypan 10-12	4
riparian	5

Source: BLM, 1993. Area in 1993 comprised 11,636 acres.

NOXIOUS WEEDS

Several undesirable plant species are present within the project area (**Table 3-24**). There are three main species of concern in theproject area; scotch thistle, Canada thistle, and salt cedar or "tamarisk." The Maggie Creek drainage immediately below Newmont's main facilities contains Scotch thistle, as do many sites throughout the study area. This species can grow up to 6 feet tall and is armed with spines, making it the most troublesome weed in the study area (BLM, 1993). Because livestock will not move through its dense infestations, it can make an area ungrazable. This weed is a prolific seed producer and its seed remains viable for several years, making it very difficult to eradicate.

The noxious weed inventory that Newmont conducted in Fall 1998 (JBR, 1998) indicated that noxious weeds were present on approximately 101 acres in the South Operations Project area. Predominant weeds present were scotch thistle, Canada thistle, and saltcedar. Areas with more than a half-acre of weeds include the James Creek diversion channel, the James Creek pond and diversion dam area, the northeast and northwest sides of the Gold Quarry North WRDF, and along the haul road on the northwest side of the Gold Quarry pit. Most all sites are primarily scotch thistle. Canada thistle occurs in the James Creek pond and diversion dam area, and saltcedar occurs on the James Creek tailing storage area.

A supplemental survey (Marinovich, 1998) identified scotch thistle present in the east half of Section 10, T33N, R51E, and in Section 18, T33N, R52E. These two locations are areas proposed for expansion as part of the SOAPA project.

RIPARIAN AREAS, WETLANDS AND WATERS OF THE U.S. AREAS

In 1993, the study area for riparian, wetland, and waters of the U.S. was the Maggie Creek, Susie Creek, Marys Creek basins and the Humboldt River from 6 miles above Carlin downstream to 6 miles below Buck Rake Jack Creek. Riparian areas and wetlands are associated with perennial and intermittent streams (JBR, 1993; Whitehorse Associates, 1995), the Humboldt River (JBR, 1992a; Rawlings and Neel, 1989), and springs and seeps (JBR, 1992b and Cedar Creek, 1997).

TABLE 3-23
ACRES PROPOSED FOR DISTURBANCE BY RANGE SITES IN THE SOAPA STUDY AREA

Land Status	Range Site Name	Acres
Previously Undisturbed	loamy 8-10	1109
	loamy 10-12	141
	south slope	41
	claypan 12-16	101
	Total	**1392**

*Total acres disturbed (new and previous) are from **Table 2-6**. Range site acres are estimated based upon amendment shown in **Figure 2-3**.

TABLE 3-24
NOXIOUS WEEDS IN THE SOAPA STUDY AREA

Designation	Plant Species	Scientific Name
Listed by the State of Nevada as "noxious weeds"	Scotch thistle	*Onapardum acanthium*
	Canada thistle	*Cirsium arvense*
	Hoary cress	*Cardaria draba*
	diffuse knapweed	*Centaurea diffusa*
	Russian knapweed	*C. repens*
	spotted knapweed	*C. maculosa*
	saltcedar	*Tamarix ramosissima*
	musk thistle	*Carduus nutans*
	perennial pepperweed	*Lepidium latifolium*
	poison hemlock	*Conium maculatum*

Source: BLM, 2000d.

Waters of the U.S. are also associated with ephemeral channels which have defined water flow boundaries. Riparian areas associated with the Humboldt River and tributaries within the study area were described in the original EIS (BLM, 1993).

Riparian Areas

Thirteen riparian vegetation types are present along tributaries to the Humboldt River within the study area (JBR, 1993). Approximately 2,136 acres of riparian areas are present within the 1993 study area. The affected riparian environments for SOAPA would include upper Lynn Creek, Fish Creek, a short segment of Marys Creek, and Maggie Creek. The most extensive riparian zones are associated with Maggie Creek (1,336 acres). All other streams have less than 40 acres each of associated riparian vegetation. The most common riparian types associated with tributary drainages include upland meadow,

streamside sedge meadow, grassy wet meadow, grassy meadow, B1 bench and B2 bench.

The types of wetlands present along the three smaller streams (not Maggie Creek) are dominated by streamside, B1 bench, B2 bench, and willow thickets. (B1 benches are above the streamside type on stream-deposited terraces and below the overall high water mark. B2 benches are secondary terraces above the B1 bench and above the overall high water mark.) Upper Lynn Creek is restricted to streamside wetlands. Fish Creek is almost exclusively streamside and B1 bench wetlands, with a small component of yellow willow thicket. Marys Creek also has cattail/pond wetlands. In addition to all these wetland types, Maggie Creek also has large components of sedge meadows, rush meadows, grassy meadows and wet grassy meadows.

As part of the Mitigation Plan for the development of the South Operations Area Project, Newmont Mining Corporation, in conjunction with the Elko BLM and Elko Land and Livestock Company, developed the Maggie Creek Watershed Restoration Project (MCWRP) in 1993 to improve streams, riparian habitats, and watershed conditions within the Maggie Creek subbasin (BLM, 1993). The MCWRP was designed to enhance 1,982 acres of riparian habitat, over 40,000 acres of upland watershed, and 82 miles of stream channel within the Maggie Creek subbasin (BLM, 1993). Components of the plan included exclosure and pasture fencing for livestock grazing management, conservation easements, water developments, water augmentation, riparian plantings, and other measures (refer to **Appendix A** Progress Report and Monitoring Analysis). Restoration of Lahontan cutthroat trout habitat was a key consideration in development of the plan.

The MCWRP includes the management and monitoring of stream and riparian habitats associated with Maggie, Coyote, Indian Jack, Little Jack, Lynn, and Simon creeks. An additional 23 springs sites were also fenced and developed where possible to provide alternate sources of water for livestock. Streams and associated riparian habitats are included within 16 pastures. Changes in grazing management on these areas have included total exclusion of livestock; exclusion of livestock until selected biological standards have been met followed by limited, prescription grazing; and, application of various grazing systems. An additional four pastures controlled by Maggie Creek Ranch were initially identified for improvement in the MCWRP; however, no changes in management of these areas is known to have occurred.

Condition of both flowing and standing water riparian habitats within the Maggie Creek basin has improved substantially as a result of implementation of the MCWRP. For additional information refer to the affected environment section of Lahontan cutthroat trout in a following section – Threatened, Endangered, Candidate, and Sensitive Species.

Spring/Seep Wetlands

Spring and seep wetlands were described in the original EIS (BLM, 1993). Approximately 195 individual or groups of springs and seeps were inventoried within the study area (JBR, 1992b).

The total wetland area associated with inventoried springs and seeps in 1993 was approximately 204 acres, of which the majority was associated with a few large sites. Springs and seeps are shown in **Figure 3-4**.

Although springs and seeps and associated wetlands cover a small area relative to upland vegetation, they have the following important functions and values:

- Livestock and wildlife watering sources;
- Increased vegetation productivity;
- Ecological diversity; and
- Groundwater discharge.

Implementation of the Mitigation Plan in 1993 included the fencing of 25 spring/seep sites (approximately 14 acres of area) (**Appendix A**). Numerous other springs were located in pastures where grazing was restricted or eliminated and conditions at these springs have also improved. Six major livestock pastures had fencing installed from 1994-1996 **(Appendix A)**. There are nine pastures that were designated "Riparian Restoration Zones" which had grazing excluded until certain standards were met; all of these are now being grazed in a manner to ensure maintenance of good riparian conditions. There are four pastures designated as "Controlled Grazing Zone"; all of these are being grazed to maintain good riparian conditions.

Newmont constructed an approximately 118 acre wetlands near the mouth of Maggie Creek. This wetland is located in an area between Interstate 80 and the East Carlin access road. A small diversion structure was placed in Maggie Creek to distribute a small amount of water along the upper end of the wetland area during the irrigation season. In the Dry Susie Creek basin, Newmont also created a wetlands near the Carlin tunnels, which comprise approximately 110 acres, but does not require diversion of water at all.

SOAPA Wetlands

The SOAPA consists of three specific areas of land where the site boundary is being expanded, including the entirety of Section 18, T33N, R52E, the east ½ of Section 15, T33N, R51E, and the northwest ¼ of Section 10, T33N, R51E. Evaluation (Cedar Creek, 1997) of these three areas for wetlands and Waters of the U.S. identified seven wetland areas **(Table 3-25)**. These areas are shown on **Figure 3-10.**

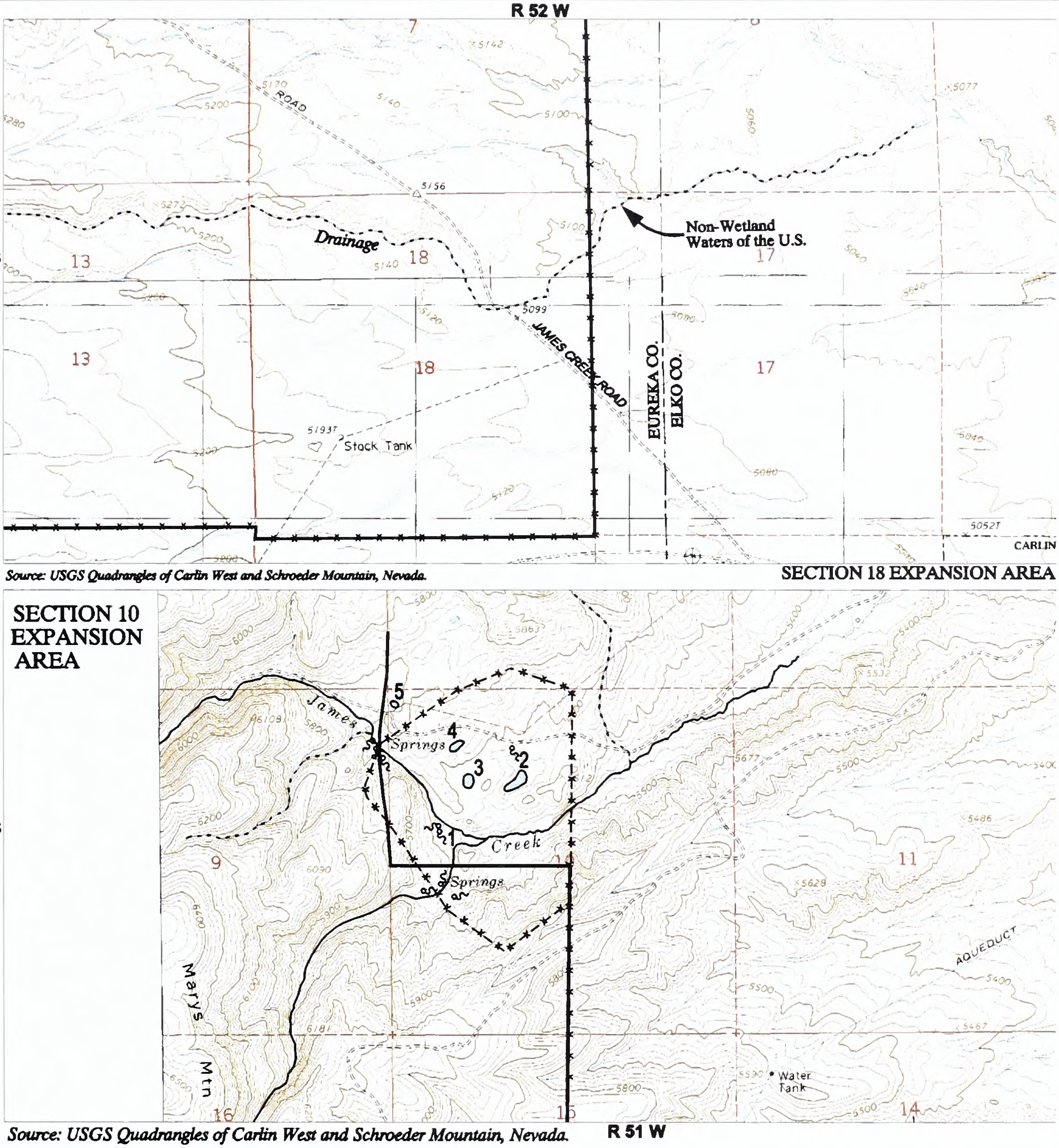
With regard to the east half of Section 15, no wetlands or Waters of the U.S. are present. Section 18 contains a drainage which traverses the section from west to east and is classified as non-wetland Waters of the U.S. No other wetlands or waters were found to occur within Section 18.

The northwest ¼ of Section 10 contains several small wetlands. All wetlands are shown on **Figure 3-10** and are listed in **Table 3-25.**

TERRESTRIAL WILDLIFE

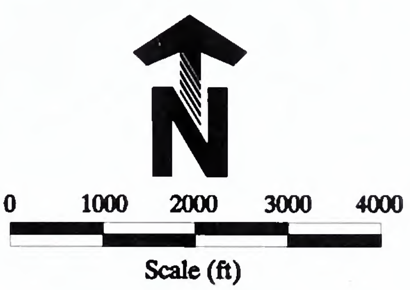
The Draft EIS for Newmont's South Operations Area Project (BLM, 1993) established the baseline for wildlife and aquatic resources. The study area for wildlife was an area roughly 20 by 30 miles centered on the South Operations Area Project. Rather than duplicate information contained in that document, this section describes only those issues and resources that have changed or are in need of further analysis. For more specific detail on any given species or groups of species, the reader should refer to the following referenced environmental documents for the South Operations Project Area:

- BLM, 1993
- JBR Environmental Consultants Inc., 1994; 1993; 1992a; 1992b; 1992c; 1992d; 1992e; 1992f; 1992g; 1990.



LEGEND

- Wetlands
- Water of the U.S.
- Boundary
- Fence



SOUTH OPERATIONS AREA PROJECT AMENDMENT	
FIGURE 3-10 WETLANDS AND WATERS OF THE U.S. IN THE SOAPA AREA	
MINE AREA: SOUTH AREA	
DATE: 6/6/00	ACAD FILE: Fig3-10.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY DS

TABLE 3-25
WETLANDS AND OTHER WATERS OF U.S.
IN SECTIONS 10 AND 18.

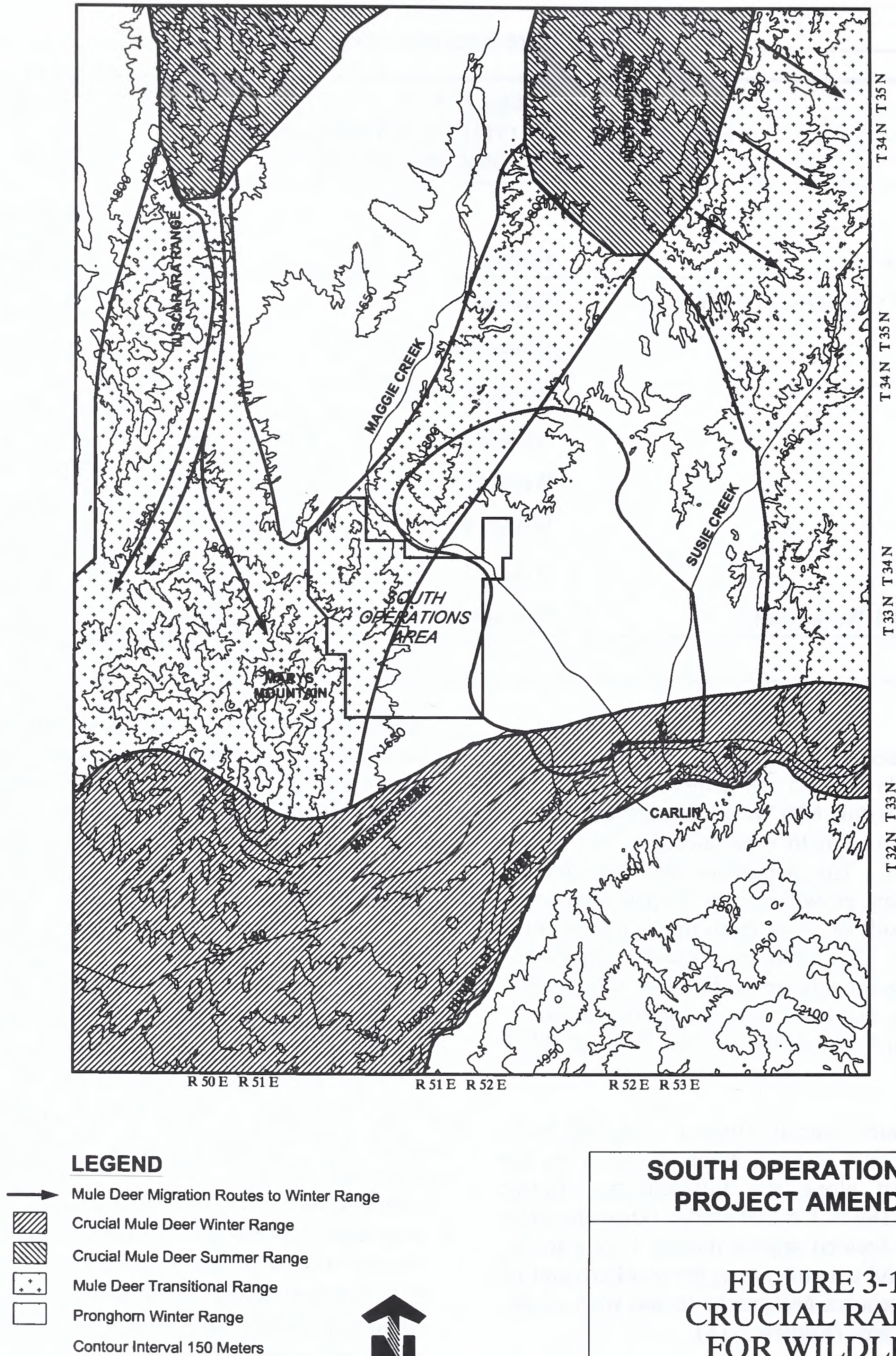
Location	Feature	Wetland Acreage	Non-Wetland Waters of the U.S. Acreage
T33N, R51W, Section 10, NW Quarter	James Creek	0.81	0.41
	Tributary to James Creek	0.06	0.06
	Wetland 1	0.28	
	Wetland 2	3.59	
	Wetland 3	1.24	
	Wetland 4	0.71	
	Wetland 5	0.53	
T33N, R52W, Section 18	Drainage (6000 feet)	0.00	0.89
Total		8.11	1.36

Mule deer are the principal big game species found throughout the project area which is located within NDOW's Management Area 6. The management area includes unit group 061-068. The population has experienced significant growth during the past four years as a result of good recruitment due to mild winters. The 1996 post season population estimate for unit group 061-068 was 13,000 animals, that is a 45 percent increase from the low that followed the severe winter of 1992-93.

Designated crucial summer range for mule deer occurs approximately 8 miles to the northeast along the Independence Range (BLM, 1993). Crucial winter range for mule deer is located approximately 1-mile to the south and extends along the southern end of the Tuscarora Mountains to the west of the project area (**Figure 3-11**).

Although no mule deer crucial habitat occurs within the project area, the northwest portion of the project area is considered transitional range. This transitional range is used as mule deer move from high summer elevations to lower winter ranges in the fall and reverse during the spring.

During the summer of 1996, northeastern Nevada experienced a bad fire season. Approximately 114,000 acres of deer habitat burned in Unit Group 067-068. Of this total, perhaps the most devastating loss was the 28,000 acres of crucial winter and transitional range near the south end of the Tuscarora Mountain Range. BLM and NDOW, in cooperation with Newmont and other concerned parties, are working to rehabilitate crucial range for mule deer in these areas. To date, approximately 5,814 acres of the most important habitat have been reseeded with a shrub, grass, and forb mix.



Source: BLM, 1993.

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-11 CRUCIAL RANGE FOR WILDLIFE

MINE AREA: SOUTH AREA	
DATE: 7/20/00	ACAD FILE: Fig3-11.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY DS

The pronghorn antelope within the project area are part of NDOW's Management Areas 6 and 7 which includes Unit Group 061, 062, 064, 071 and 073 and Unit Group 067-068. Unit Group 067-068 comprises the west slope of the South Tuscarora Range in the Boulder Valley area and includes the SOAPA project site. The population of this herd continues to increase following the 1992-1993 winter die-off. Good fawn production, combined with favorable winter conditions have contributed to this trend. However, the lack of winter range will eventually limit these herds. The current (April 2000) population estimate for the 067-068 Unit Group is 550 antelope. The eastern portion of the project area supports pronghorn winter range.

Antelope distribution extends from the North Tuscarora Range to Interstate 80 near Dunphy. Antelope in Unit Group 061-073 winter in the vicinity of the project area. This population is estimated to be 1,300 animals. Antelope distribution in Unit Group 061-073 extends as far north as Merritt Mountain, as far east as Stagg Mountain, and as far south as the project area. The winter range for this herd is considered crucial and is the limiting factor for this herd.

The closest population of California bighorn sheep to the SOAPA area is the Rock Creek herd, estimated at 65 animals. This population is distributed from lower Rock Creek Gorge to Willow Creek reservoir on the west side of the Tuscarora Range. The southwestern portion of their range are scattered throughout Kelly Creek, Jakes Creek, and the Owyhee Bluffs. Sheep have been observed in the South Fork of the Little Humboldt River drainage. There have been no reported observations of sheep within the South Operations Area.

Other species of importance within the project area include sage grouse, golden eagles, red-tailed hawks, ferruginous hawks, Swainson's hawks, prairie falcons, American kestrels, northern goshawk, northern harrier, and great horned and long-eared owls. In addition, non-game birds, waterfowl, shorebirds, reptiles, and amphibians also occur within or near the project area. These species are expected to occur only within areas of suitable habitat. However, specific ranges have not been identified.

AQUATIC HABITAT AND FISHERIES

Aquatic community structure and composition are generally the same as was discussed in the original EIS (BLM, 1993). However, new fisheries studies have been conducted within the project area since the EIS was prepared. Sponsors included Barrick Goldstrike Mines, Inc. (BIO/WEST, 1994), Newmont (AATA, 1997), and the Nevada Division of Wildlife (1996, 1997, 1999). Streams surveyed during BioWest's study included Beaver Creek, Little Beaver Creek, Toro Canyon Creek, three tributaries to Toro Canyon Creek, Williams Canyon Creek, and Barber Creek. Streams surveyed during AATA's study included Lynn, Simon, Fish, Jack, Little Jack, Spring, Coyote, Beaver, Little Beaver, Maggie, Cottonwood, and Susie creeks. Streams surveyed by NDOW included Little Jack Creek, Maggie Creek, and Coyote Creek in 1996, 1997, and 1999, respectively. These streams and aquatic habitat areas are shown in **Figure 3-12**, and together they constitute the study area for aquatics.

Fish species found during these studies included Lahontan speckled dace, Lahontan redside shiner, Tahoe sucker, and Lahontan cutthroat trout. Refer to the following section

of this document for a detailed description of Lahontan cutthroat trout and aquatic habitats within the Maggie Creek Basin. Besides Lahontan cutthroat trout, no trout species were found in any of the surveyed streams in either the 1994 or 1997 surveys. Brook trout were found in Spring Creek in 1992 (JBR, 1992g), but none were found during the 1997 survey of Spring Creek.

THREATENED, ENDANGERED, CANDIDATE AND SENSITIVE SPECIES

This section discusses special status wildlife species that include those listed as threatened or endangered under the federal Endangered Species Act of 1973 as amended, species proposed for federal listing (candidate), and other species of concern identified either by the USFWS, NDOW or BLM as sensitive, unique or rare which have the potential for occurrence within the project area. **Table 3-26** includes Threatened, Endangered, Candidate, and Sensitive species of plants and animals on lands administered by Elko BLM that could potentially occur in the SOAPA study area as of December 15, 1999. Nevada BLM policy is to provide BLM sensitive species and State of Nevada Listed Species with the same level of protection as is provided for candidate species as stated in the BLM Manual 6840.06C.

The USFWS (1997) has designated the Lahontan cutthroat trout and bald eagle as threatened species and the spotted frog as a candidate species under the Endangered Species Act. These three species have the potential to occur on or in the vicinity of the project area. **Table 3-26** lists the USFWS-listed Threatened, Endangered, and Candidate species. Nevada-listed species and BLM's Sensitive species potentially occurring in the SOAPA area are also contained in this table.

Bald Eagle (Threatened)

The bald eagle occurs in Northern Nevada as a winter migrant and visitor (Ryser, 1985). During the winter, eagles usually occur in areas near bodies of water which remain free or partially free of ice. Bald eagles usually winter near unfrozen bodies of water because fish and waterfowl are common prey and riparian areas often have cottonwood trees used as perches.

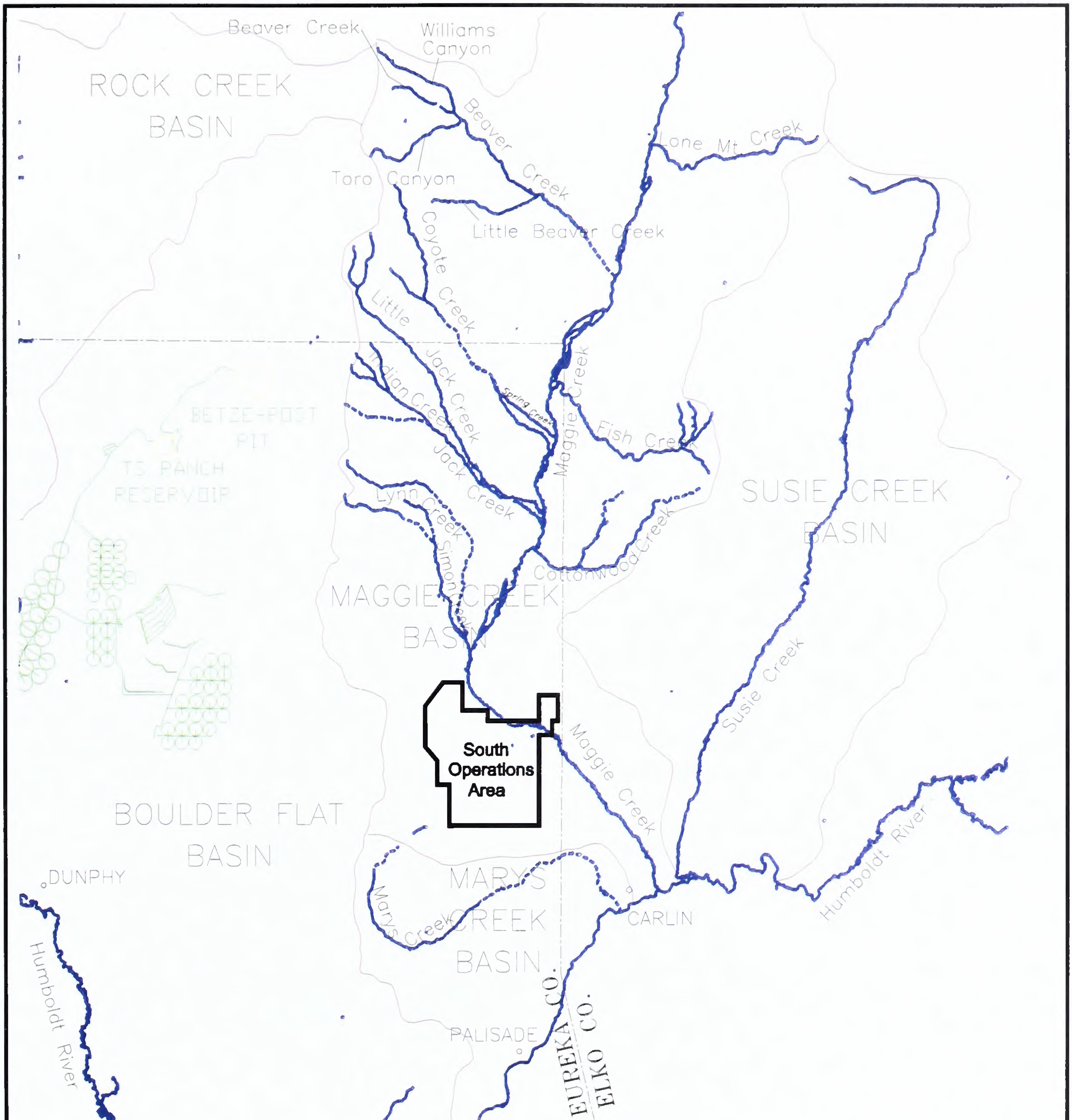
No bald eagles were observed in the South Operations Area in 1991-92, although the species may occur in the area. Wintering bald eagles were observed in 1992 along the Humboldt River at five locations between Elko and Battle Mountain (NDOW, 1992).

Winter counts have reported bald eagles near Wilson and Wildhorse Reservoirs, which are located north of the South Operations Area. No records of nests or communal roosts in or near the South Operations Area are known.

Lahontan Cutthroat Trout (Threatened)

Historically, Lahontan cutthroat trout occupied streams throughout the Humboldt River drainage, including the mainstem of the Humboldt River. Habitat degradation, water development projects, and introduction of non-native trout that hybridize and compete with Lahontan cutthroat trout have eliminated this species over much of its former range.

Lahontan cutthroat trout has been found to inhabit 447 miles of streams in Nevada with stream-dwelling populations estimated at 110,000 fish (USFWS, 1995). Within the



LEGEND

Basin Boundaries

Conveyance/Irrigation

Streams

Intermittent Streams

N

0 5 10

Scale in Miles

Source: BLM, 2000b

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-12
AQUATIC HABITAT AREAS

MINE AREA: SOUTH AREA	
DATE: 8/1/00	ACAD FILE: Fig3-12.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY DS

TABLE 3-26
THREATENED, ENDANGERED, CANDIDATE, AND SENSITIVE SPECIES OF PLANTS AND ANIMALS POTENTIALLY OCCURRING IN THE SOAPA STUDY AREA[1]
(as of December 1999)

Common Name	Scientific Name	Status	Probability of Occurrence in Study Area
Mammals			
Spotted bat	*Euderma maculatum*	Nevada-Listed[2,3]	Low
Small-footed myotis	*Myotis ciliolabrum*	BLM-Sensitive	Possible
Long-eared myotis	*Myotis evotis*	BLM-Sensitive	Likely
Fringed myotis	*Myotis thysanodes*	BLM-Sensitive	Possible
Long-legged myotis	*Myotis volans*	BLM-Sensitive	Low
Pale Townsend's big-eared bat	*Plecotus townsendii pallescens*	BLM-Sensitive	Likely
Pacific Townsend's big-eared bat	*Plecotus townsendi townsendii*	BLM-Sensitive	Likely
Preble's shrew	*Sorex preblei*	BLM-Sensitive	Possible
Birds			
Bald eagle	*Haliaeetus leucocephalus*	Threatened	Likely
White-faced ibis	*Plegadis chihi*	Nevada-Listed	Likely
Northern Goshawk	*Accipiter gentilis*	Nevada-Listed	Low
Ferruginous Hawk	*Buteo regalis*	Nevada-Listed	Likely
Burrowing Owl	*Athene Cunicularia*	Nevada-Listed	Possible
Golden eagle	*Aquila chrysaetos*	Nevada-Listed	Likely
Swainson's hawk	*Buteo swainsoni*	Nevada-Listed	Low
Osprey	*Pandion haliatus*	Nevada-Listed	Low
Western sage grouse	*Centrocercus urophasianus*	BLM-Sensitive	Present
Fish			
Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*	Threatened	Likely
Mollusks			
California Floater	*Anodonta californiensis*	BLM-Sensitive	Likely
Springsnails	*Pyrgulopsis sp.*	BLM-Sensitive	Present
Butterfly			
Nevada Viceroy	*Limenitus archippus lahontani*	BLM-Sensitive	Likely
Amphibians			
Columbia Spotted frog	*Rana luteiventris*	Candidate	Likely
Plants			
Lewis Buckwheat	*Eriogonum lewisii*	BLM-Sensitive and Nevada-Listed	Low

Source: U.S. Fish and Wildlife Service, 1997; BLM, 1997; NDOW, 1996b.

1 Based on input provided by BLM, Nevada Division of Wildlife, and U.S. Fish and Wildlife Service in BLM Instruction Memorandum No. NV-98-013 (February 27, 1998). BLM Elko Field Office input provided for BLM Instruction Memorandum No. NV-98-013 was entitled "Former Candidate Category 2 Species On Or Suspected On Elko District - BLM Lands Recommended As BLM Sensitive Species As Of 5/96." Information per October 25, 1999, Federal Register; peregrine falcon is no longer listed as a threatened species and, in effect, is no longer "listed."

2 Per wording for Table IIa. In BLM Instruction Memorandum No. NV-98-013 for Nevada State Protected Animals that Meet BLM's 6840 Policy Definition: Species of animals occurring on BLM-managed lands in Nevada that are: (1) "protected" under authority of Nevada Administrative Codes 503.100 - 503.104; (2) also have been determined to meet BLM's policy definition of "listing by a State in a category implying potential endangerment or extinction"; and (3) are not already included as BLM Special Status Species under federally listed, proposed, or candidate species.

3 Nevada BLM policy is to provide these species with the same level of protection as is provided for candidate species in BLM Manual 6840.06C.

Humboldt River Basin, Lahontan cutthroat trout occurs in 83 to 93 streams and approximately 318 miles of riverine habitat. This accounts for approximately 14 percent of the historical habitat. Currently, the Humboldt River basin supports the greatest number of fluvial Lahontan cutthroat trout populations native to the Lahontan basin (USFWS, 1995).

Populations of Lahontan cutthroat trout in the Maggie Creek subbasin have declined markedly since the turn of the century. Most of Maggie Creek (including all of Maggie Creek within the South Operations Area Project mitigation area) is in an upward trend. Habitat conditions are no longer as confining to Lahontan cutthroat trout as in years past (Evans, 2000). Although large number of other salmonids were stocked throughout streams in the Tuscarora Mountains in the early- to mid-1900's, nonnative trout have apparently been unable to persist in these streams over time.

The Maggie Creek subbasin has a number of creeks that either support or have the potential to support Lahontan cutthroat trout; all within the upper portion of the Maggie Creek subbasin. Several fish inventories have been conducted within these creeks (BLM, 1994; JBR, 1992g; BIO/WEST, 1994; AATA, 1997; NDOW, 1996, 1997, 1999). Studies indicate that Lahontan cutthroat trout occur in 9 of the 12 streams with potential to support trout in the Maggie Creek subbasin (BLM, 1994). These streams include Maggie, Little Jack, Jack, Beaver, Toro Canyon, Coyote, Little Beaver, Williams Canyon, and Lone Mountain creeks.

Three of the main tributary streams containing Lahontan cutthroat trout (Coyote, Little Jack, and Beaver creeks) were found to have fish migration barriers (perched culverts) at the Maggie Creek Road which prevent movement of populations to the various streams. Therefore, each Lahontan cutthroat trout population recorded is isolated and does not have genetic interchange between populations (AATA, 1997). NDOW has observed very large Lahontan cutthroat trout individuals at the lowest sampling stations in Beaver and Coyote creeks, which they interpret to mean that these large sized fish may be able to negotiate these barriers during the spring spawning migration (NDOW, 2000). Lack of perennial stream flow in the lower reaches of these drainages also limits potential for fish in Maggie Creek to access tributary streams. As a result, individual tributary stream populations are isolated from the main stem of Maggie Creek and from each other. Therefore, the entire life history of the reproductive populations of Lahontan cutthroat trout must be met in the upper canyons (above the canyon mouths) where there is continuous flow and summer conditions were found to be well below upper incipient lethal temperatures. Previous documentation of Lahontan cutthroat trout in lower reaches of these streams (including all of Maggie Creek) are thought to be outwash victims that are essentially lost from reproductive populations occurring in the upper canyons.

Drainages within the general project area containing Lahontan cutthroat trout have been subjected to grazing pressure of varying intensities for approximately 130 years. Historic impacts to Lahontan cutthroat trout habitats have been previously documented (BLM, 1993). Since the MCWRP was implemented in 1993, improvement of riparian habitat including streams occupied by Lahontan cutthroat trout has been excellent (BLM, 1997b; BLM, 1999). Refer to discussion under Affected Area for Riparian Areas earlier in this chapter for more information on the MCWRP. Streams which were once characterized by eroding streambanks and a wide, shallow channel

profile now support healthy functioning riparian zones and stable, well vegetated streambanks. **Appendix A** documents the success of implementattion of the MCWRP. It also contains "before and after" photographs of Maggie and Coyote creeks. Where biological criteria have been established for the reintroduction of grazing, standards have been met and grazing has been applied on a prescription basis since 1997. Lahontan cutthroat trout is currently abundant in both Little Jack and Coyote creeks. New populations were also discovered in Jack Creek in 1997 and Lone Mountain Creek in 2000.

Columbia Spotted Frog (Candidate)

This species inhabits areas around permanent sources of water such as marshy edges of ponds or lakes, in algae-grown overflow pools or streams, or near springs with emergent vegetation during the breeding season (Spahr, 1991). They move considerable distances from water after breeding, often frequenting mixed conifer and subalpine forests, grasslands, and brushlands (Spahr, 1991).

The spotted frog was observed within the study area during 1992 baseline surveys (JBR, 1992g). Specimens were collected along Coyote and Little Jack Creeks. Although no spotted frogs were collected in Maggie Creek, potential habitat is present, and their occurrence in this drainage is possible.

Spotted Bat

This species has not been reported for northeastern Nevada but is typically found in rough desert terrain with limestone or sandstone cliffs (Zevaloff, 1988; Watkins, 1977). Little is known about the biology of this species, but the limited literature available suggests that they prefer crevices in rocky, cliff habitat for roost sites (Leonard and Fenton, 1983; Easterla, 1973), especially where rocky cliffs occur in proximity to riparian areas (Findley et al., 1975). Although areas of rock outcrop near water within the project area may represent suitable habitat for this species, no observations of this species have been recorded over the course of baseline surveys.

Small-footed Myotis

The small-footed myotis is a bat widely distributed as a year-round resident of the western United States, including Nevada. It uses a variety of habitats in rocky and canyonland areas for roosting and foraging. Day and maternity roosts have been found in cliffs, boulders, and on talus slopes. Night and hibernation roosts have been found in small caves and abandoned mine adits.

Areas of rock outcrops, mine adits, and buildings in the project area could potentially provide suitable roost and/or maternity sites for the small-footed myotis. One small-footed myotis was captured in T35N, R50E, Section 9 during a bat survey in 1996 for Newmont's Lantern Mine Expansion Project. This location is approximately 10 miles northwest of the SOAPA project area (BLM, 1993).

Long-eared Myotis

The long-eared myotis bat is widespread throughout most of the western United States and is found at elevations ranging from sea level to 8,500 feet (Manning and Knox Jones, 1989). Preferred habitat consists of stream or riparian areas adjacent to forest edges. This species roosts in buildings and under the bark of trees, but caves and abandoned mines are also used as temporary roosts between

foraging flights at night (Barbour and Davis, 1969).

A total of three long-eared myotis was captured at a stock pond on Soap Creek within the study area during 1992. Although no other long-eared myotis were collected during the effort, it was concluded that the species was common within the study area.

Fringed Myotis

The fringed myotis bat is a widely distributed species that may be found in northeastern Nevada. This species is generally found at middle elevations in grasslands and woodlands, and on occasion has been observed in higher elevations in forested habitats (BLM, 1993). Caves, mines, or buildings are used as roost sites. Day roosts may occasionally be located in tree cavities.

No documented occurrences of the fringed myotis in Elko County have been reported. No specimens were captured or observed during surveys conducted in the South Operations study area during 1992 (BLM, 1993).

Long-legged Myotis

Long-legged myotis bats have been found in a variety of habitats, but prefer higher elevation coniferous forests (Zeveloff, 1988). This species roosts in buildings, under loose tree bark, and in rock crevices and fissures in the ground. Caves and abandoned mines are used for temporary roosting between foraging sites at night (Barbour and Davis, 1969).

Suitable habitat for this species exists within the higher elevation portions of the baseline study areas, but it was not recorded by surveys in the study area (BLM, 1993).

Townsend's Big-Eared Bat (Pale & Pacific)

The pale Townsend's big-eared bat is one of two subspecies of the Townsend's (or western) big-eared bat that may occur in northeastern Nevada. Available information suggested the Pacific western big-eared bat occurs in northeastern Nevada, and the pale Townsend's big-eared bat has also been found there by Bradley (1995).

This bat uses a variety of habitats including pinyon-juniper, shrub-steppe grasslands, deciduous forest, and mixed coniferous forests at elevations ranging from sea level to 10,000 feet (BLM, 1993). However, because it forages over water, it is most abundant in mesic habitats. This species roosts primarily in caves, mine shafts, or adits.

Townsend's big-eared bats were observed within the study area in abandoned mine adits in the upper Lynn Creek drainage (BLM, 1993). Two males in active breeding condition were captured in mine adits and bats suspected to be big-eared bats were observed flying over springs and ponds near the abandoned mine adits (BLM, 1993). However, the ponds washed out in the spring runoff in 1993. Therefore, it is unknown whether the bats still inhabit the adits along Lynn Creek. Although the Humboldt River was not surveyed, it is likely that the area is used by foraging Townsend's big-eared bats (BLM, 1993).

Preble's Shrew

Few site-specific data are available for the Preble's shrew, although it has been reported in the northern portion of the Great Basin. Suitable habitat ranges among sagebrush, grasslands, openings in subalpine forest, and

alpine tundra (BLM, 1993). This small mammal also is believed to occupy wetland or marshy habitats containing adequate emergent and woody plant species (BLM, 1993). The Preble's shrew has been documented in northern Elko County (BLM, 2000b). Currently, it is unknown whether this species occurs in the study area; however, suitable habitat occurs east of the Tuscarora Mountains (BLM 1996). The Preble's shrew also may occur along the Humboldt River drainage, since suitable habitat may be present along the river corridor and associated floodplains.

Northern Goshawk

In the Independence Mountains of Nevada, studies have determined that goshawks inhabit the shrub steppe habitat type and prefer small widely scattered aspen groves for nesting (Younk and Bechard, 1994). These stands are generally older and often on north- or east-facing slopes. Furthermore, nest sites preferred by the birds are on minor slopes (four to 39 percent) within 100 yards of water such as springs and streams.

Goshawks prey on a variety of species, particularly small mammals and birds in timber areas. Foraging has been documented to occur in heavy canopied forests with open understories. Within the Independence Mountains, goshawks have been observed foraging in aspen stands, in small sagebrush inclusions within aspen stands, along aspen stand ecotones, and in open sagebrush areas (Younk and Bechard, 1994).

Goshawks may nest within the juniper habitats of the project area, however, nesting habitat is limited within the area. They also may forage within the juniper and sagebrush habitats of the area.

Ferruginous Hawk

The ferruginous hawk, the largest North American buteo, is a year-round resident (at very low densities during the winter) of northern Nevada (Evans, 1983). It prefers open habitats, including grasslands, shrublands, steppe-desert areas, and the edges of pinyon-juniper woodlands. In contrast, they consistently avoid extensively forested areas (including the interior pinyon-juniper woodlands) and mountainous areas with steep-sided canyons and cliffs.

Ferruginous hawks are probably the most adaptable nesters of any raptors (Call, 1978). They will nest in trees when possible, preferably the largest trees available. However, when trees are unavailable they will nest on rocky outcrops, low cliffs, buttes, cutbanks, and a variety of human-made structures. Ferruginous hawk nests have been observed on metal transmission line towers, wooden power poles, haystacks, chimneys, windmills, abandoned buildings, and spoil piles at mine sites.

Ferruginous hawks are known to concentrate in the wet meadow along upper Maggie Creek during the late summer and early fall. This appears to be a staging area where the birds feed on large populations of small mammals prior to the birds migration.

Burrowing Owl

The western burrowing owl is primarily a summer breeder in northeastern Nevada that migrates south for the winter. It is a small, ground-nesting owl that nests in burrows excavated by rodents, badgers, or foxes. This owl generally selects burrows in open, level sites with low or desert vegetation. In addition, elevated perches for observation, such as mounds, fence posts, or utility poles

characterize good habitat for the burrowing owl (Johnsgard, 1986).

Burrowing owls have been observed by BLM personnel nesting throughout the area between the South Operations Area and the Carlin Mine (as well as Welches Canyon and the eastern side of Richmond Mountain).

White-Faced Ibis

The white-faced ibis (a shore bird) feeds in wet meadows and shallow water found along streams and lakes. They nest in areas with extensive water and build their nests in heavy emergent marsh vegetation (Dinsmore, 1983). Birds feed on frogs, grasshoppers, crayfish, and other invertebrates.

This species was observed in the study area along the Humboldt River and near the confluence of Simon and Maggie Creeks (JBR, 1992g). A total of 15 ibis was observed at the Maggie Creek site. Although no young were observed, it is possible that nesting could occur at this location (BLM, 1993). Approximately 950 acres of wet meadows along Maggie, Coyote, and Little Jack Creeks were considered as potential nesting and/or foraging habitat for this species within the study area (BLM, 1993).

Golden Eagle

Golden eagles most often nest on cliffs and sometimes in trees. Golden eagles forage widely over open habitats, including grasslands, sagebrush, farmlands, and tundra. Suitable mixes of cliffs and sagebrush can support high concentrations of golden eagles, especially where there is a large rabbit supply. Golden eagles prey mainly upon rodents, hares, rabbits, ground squirrels, marmots, and prairie dogs, and in winter, on carrion (Kingery, 1998). Golden eagles are likely to be present within the project area.

Swainson's Hawk

Swainson's hawks inhabit prairies, plains, deserts, large mountain valleys, savannahs, open pine-oak woodlands, and cultivated lands with scattered trees. They nest in isolated trees, in shrubs and trees along wetlands and drainages, in windbreaks in fields and around farmsteads, in giant cactus, or on the crossbars of telephone poles. They occasionally nest on the ground, on low cliffs, on rocky pinnacles, or on cutbanks. They may build nests up to 100 feet above ground in cottonwoods, or lower in willows or other shrubs. May repair and use the same nest year after year. They hunt primarily from perches such as fence posts or low trees and from a vantage point on the ground. Their diet consists of small mammals, birds, fishes, salamanders, frogs, snakes, and insects. Swainson's hawks are likely to be present within the project area.

Osprey

Ospreys are migratory and spend their winters in Mexico and Central and South America. Ospreys return to Alaska in late April. The nest is situated near water, atop trees, posts, and rock pinnacles, or even on the ground. The osprey's diet is mainly fish. They are not particular about the species of fish they catch, but they can only catch fish swimming within 3 feet (1 m) of the water's surface. They rarely take fish over 16 inches (40 cm) long. Ospreys occasionally capture small mammals, birds, amphibians, and reptiles. Ospreys have a low chance of occurring in the project area due to the lack of water and fish.

Western Sage Grouse

Sage grouse are year-long residents of the SOAPA area that are normally associated with sagebrush habitats in rolling hills and benches along drainages. Their breeding sites are called leks and six leks have been identified and named in the study area: Upper Fish Creek Bench, Lower Fish Creek Bench, Richmond Mountains, South Marys Mountain, South Jack Creek, and Palisade Complex. Mesic habitats are especially important to sage grouse in summer and autumn, as upland habitats in the study area do not provide the quality and quantity of food for growth of young and feather molting. Low elevation sagebrush stands on benches or south or west-facing slopes may be relatively more important, particularly during severe winters.

California Floater

The California floater is a freshwater mussel historically found in unpolluted lakes and streams in western North America from British Columbia to Mexico (Hulen, 1988). This species can reproduce only in association with certain fish that serve as hosts for the mussel's parasitic life stage. At present, the host species are not known. When the host fish or fishes are eliminated or greatly reduced in numbers, mussel populations decline and eventually disappear (Bequaert and Miller, 1973). According to Call and Gilbert (1893), California floaters were once abundant in the Humboldt River. Hamlin (BLM, 1993) reported its presence in the North Fork of the Humboldt River. Two live mussel specimens were found and photographed on Maggie Creek in late June and early July of 1993 (Worley, 1993). The mussels were identified as California floaters on the basis of the photographs (McGuire, 1993). One of the mussels was found immediately north of the confluence of the East Fork of Cottonwood Creek, while the second was observed approximately half way between the confluences of Cottonwood and Jack/Little Jack creeks. McGuire (1993) also reported finding old California floater shells in the vicinity of the Maggie Creek Narrows in July of 1993.

Springsnails

Springsnails, a group of mollusks that are found in perennial springs and seeps, are considered important organisms due to their restricted distribution and native origin. Although the taxonomic classification of springsnails below the family level is difficult, most springsnails known from the study area are of the Genus *Pyrgulopsis*. Springsnails have been collected at a limited number of springs and seeps within the SOAPA area (JBR, 1992g).

Based on surveys conducted in 65 springs and seeps in 1992, springsnails were collected at one site in the SOAPA area (BLM, 2000b). *Pyrgulopsis bryantwalheri* was present in Warm Spring which is located near the Humboldt River about three miles south of Carlin. Estimated density at this collection site was 1,000/m^2. Habitat conditions in springs supporting springsnails showed the following characteristics. Springsnails usually were confined to the spring source and a wetted area immediately downstream from the spring. The springs also exhibited low to moderately high discharges (5 to greater than 30 gpm), stable substrates consisting of gravel, cobble, or boulder, and dense growth of aquatic vegetation such as *Ranunculus aquaticus* or *Nasturtium* (BLM, 2000). Springsnails often decline in density downstream of stream sources, presumably reflecting their requirement for stable temperature, chemistry, and flow regime (BLM, 2000b).

Nevada Viceroy

The Nevada viceroy butterfly occurs in moist open or shrubby areas such as lake and swamp edges, willow thickets, valley bottoms, wet meadows, and roadsides. Host species include cottonwoods and willows. During the day males stay near host plants to find females. The females lay eggs on the tips of the leaves of the host plants. The caterpillars eat the eggshells after they hatch, then feed on catkins and leaves. Adults feed on aphid honey, carrion, dung, and decaying fungi. Later generations feed on flowers, such as asters, goldenrod, and Canada thistle. There have been confirmed reports of Nevada viceroys in Elko County (Struttmann, 1998).

The Nevada viceroy has been documented within the study area along the Humboldt River and Maggie Creek. This species may potentially occur in the willow habitats along Little Jack and Coyote Creeks.

Lewis Buckwheat

Lewis Buckwheat has not been reported in the study area but could be present on rocky, high-elevation sagebrush ridges above 8,300 feet. It is known to occur in the Independence Mountains and Elk Mountain in Elko County. Because the study area is below 8,300 feet in elevation, this plant would not be expected to occur (BLM, 1993).

LIVESTOCK GRAZING

The study area for grazing is an area roughly 35 miles by 25 miles centered on the South Operations Area Project. Livestock grazing is a major land use within the study area. Twelve livestock grazing allotments comprise the study area for grazing (**Figure 3-13**). Grazing allotments are areas of public and private land used by qualified permittees for livestock grazing.

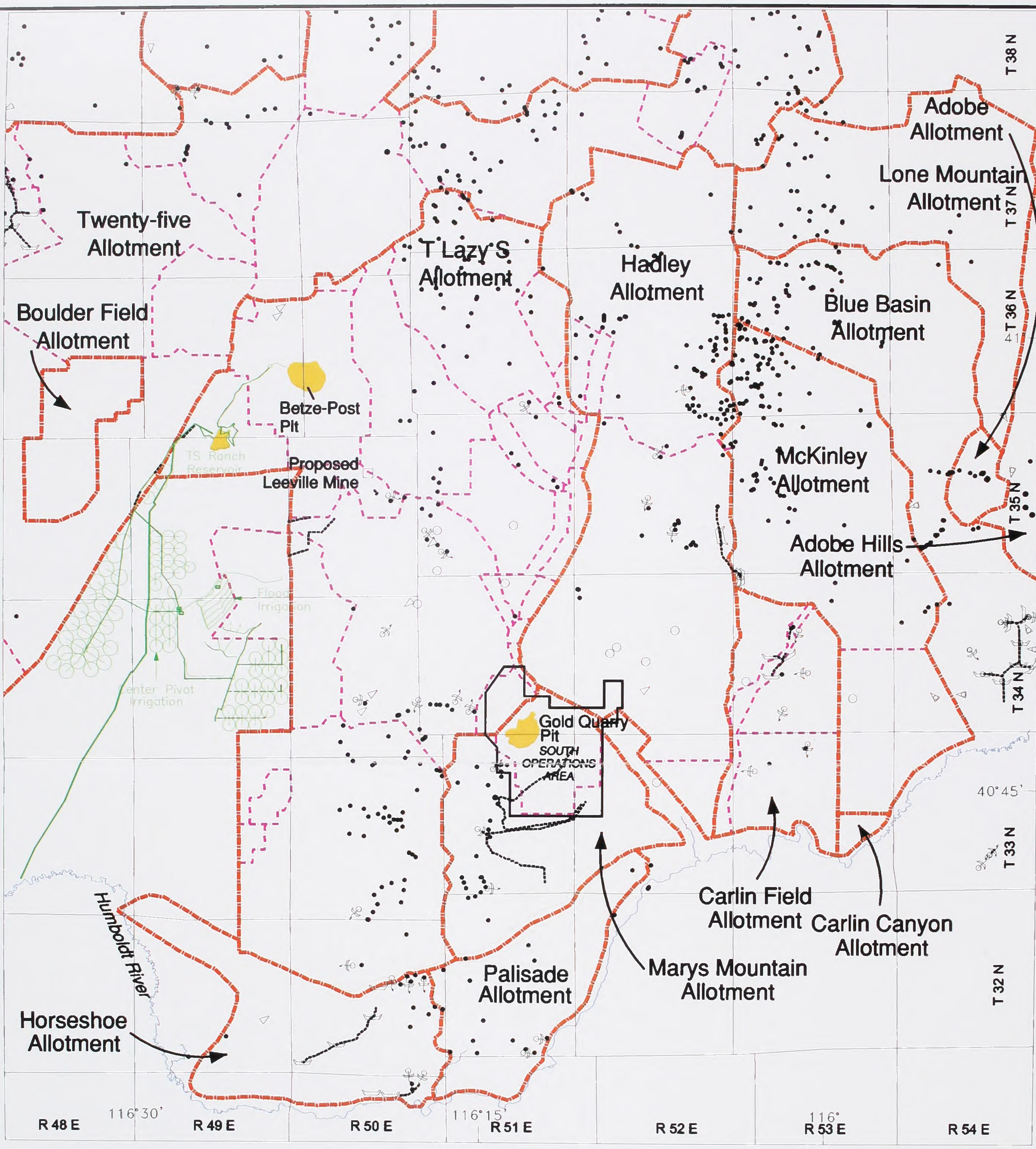
Grazing within an allotment is administered by BLM. Four of the allotments in the area are licensed to one permittee, and the remaining eight allotments are licensed to different permittees. Existing mine area disturbance is fenced to prevent livestock use, and includes a portion of the T Lazy S and Marys Mountain allotment. Information pertinent to each grazing allotment is presented in **Table 3-27.** Range improvements within the area are shown in **Figure 3-13**.

RECREATION

The regional study area for the general description of recreation resources is the public land administered by the BLM Elko Field Office which is in northeastern Nevada. The proposed project area is located in Eureka and Elko counties.

The overall objective for recreation management on public lands managed by the Elko Field Office is to provide a wide range of recreation opportunities. The majority of the Elko RMP area has been designated as "open" for off-highway vehicles. Off-highway vehicles use in the Special Recreation Management Areas and Wilderness Study Areas is "limited" to designated roads and trails. Off-road vehicle use is concentrated near the cities and towns.

There are numerous recreation areas on public lands in the RMP area managed by the BLM, Humboldt-Toiyabe National Forest, the State of Nevada, and the U.S. Fish and Wildlife Service. These areas are described in the original EIS (BLM, 1993). The nearest recreation area is the Carlin Canyon Historical Wayside located about five miles east of Carlin. This interpretive site was completed



LEGEND

- Allotment Boundary
- Pasture Boundary
- Existing Water Pipeline
- Water Trough
- Stock Pond
- Spring
- Improved Spring
- Stock Well
- Center Pivot Irrigation

N

0 6 12

Scale in Miles

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-13
GRAZING ALLOTMENTS AND SELECTED RANGE IMPROVEMENTS

MINE AREA: SOUTH AREA	
DATE: 8/3/00	ACAD FILE: Fig3-13.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY EG

TABLE 3-27
LIVESTOCK GRAZING ALLOTMENTS IN THE STUDY AREA

Allotment	Permittee	Management category [1]	Public land (AUMs) [2]	Percent public land	Predominant range condition[3]	Percent of total land base [4]	Number of animals run	Season of use	Type of operation
Carlin Canyon FFR [5]	Maggie Creek Ranch	C	51	100	mid-seral		34 cattle	May 1 to June 15	commercial cow/calf
Carlin Field	Maggie Creek Ranch	I	2,442	100	UNK[6]		335 cattle	April 1 to Dec 20	commercial cow/calf
McKinley FFR[5]	Maggie Creek Ranch	M	727	100	late seral	30[7]	91 cattle	April 1 to Nov 29	commercial cow/calf
Hadley	Maggie Creek Ranch	I	4,276	49	early to mid-seral		1,119 cattle	April 1 to Dec 20	commercial cow/calf
			206	100 (FFR)			202 cattle	year long	
Horseshoe	Zeda, Inc. Horseshoe Ranch	I	1,489	36-46	mid-seral	25	595 cattle	March 10 to Sep 30	commercial cow/calf
			140	100 (FFR)			200 cattle	year long	
Marys Mountain	Elko Land & Livestock	C	1,408	51	mid-seral	45	324 cattle	Feb 15 to Oct 31	commercial cow/calf
Palisade	Palisade Ranch	C	1,335	47	mid-seral	75	443 cattle	April 6 to Oct 27	commercial cow/calf
T Lazy S (TS)	Elko Land & Livestock	I	11,797[8]	44	early to mid-seral	19	2,718 cattle;	Feb 15 to Nov 30	commercial cow/calf
			202	100 (FFR)			350 cattle	year long	
Blue Basin	Heguy Ranches	NA	4,265	96	NA	NA	584 cattle 9 horses	Apr 1 to Nov 15	commercial cow/calf
Lone Mountain	Garrett Family	NA	7,202	64	NA	NA	1,546 cattle; 2,000 cattle; 1,000 cattle	4/15-7/15 7/15-9/30 10/1-11/15	commercial cow/calf
Adobe	Bruce Miller	NA	526	86	NA	NA	221 cattle	Apr 16 to Oct 15	commercial cow/calf
Adobe Hills	Samuel Layton	NA	2,208	61	NA	NA	696 cattle 10 horses	Apr 1 to Oct 30	commercial cow/calf

Source: BLM, 1993; BLM, 2000b.

[1] Management category definitions:
I = Improve the existing condition of the allotment.
C = Manage in a custodial fashion to prevent deterioration of current conditions.
M = To maintain or improve range condtions.

[2] An AUM (animal unit month) is the amount of forage required to sustain one cow and calf for a 1-month period.

[3] Seral stage describes native range condition. Early, mid, and late seral stage equate to poor, fair, and good range condition, respectively.

[4] Percent of the permittees' total deeded and leased land base that is accounted for by the allotment.

[5] FFR = fenced federal range.

[6] UNK = unknown

[7] Carlin Field, Carlin Canyon and Hadley allotments are used as one unit by the permittee, and their combined acreage constitutes approximately 30 percent of the permittees' total land base.

[8] 1,202 AUMs have been suspended due to wild fires that occurred in 1999. This figure (11,797) does not reflect this suspension.

in 1999 and consists of two shelters with benches and three interpretive panels. Another nearby recreation area is the BLM's South Fork Canyon Special Recreation Management Area located about 20 miles southeast of the project area.

State Recreation Areas

State Recreation Areas include the South Fork State Recreation Area and the Wild Horse State Recreation Area. The South Fork State Recreation Area is 15 miles southeast of Carlin. The Wild Horse State Recreation Area is approximately 70 miles northeast of Carlin. Visitation data to each State Recreation Area is summarized in **Table 3-28.** Visits to state parks and recreation areas decreased in northeast Nevada between 1987 and 1991-92. By 1997, the number of visits had increased to higher levels than the 1987 numbers. Drought conditions in 1985-1992 (BLM, 1993) which could adversely affect water-related recreation activities such as fishing and boating in the reservoirs at South Fork and Wild Horse State Recreation Areas are a reasonable explanation for decreases in visits during those years. The increase in visits since 1992 reflect economic growth and increases in population during the 1990's as described in the section on Social and Economic Resources.

Nevada Statewide Comprehensive Outdoor Recreation Plan

The 1987 Statewide Comprehensive Outdoor Recreation Plan published by the Parks Division of the Nevada Department of Conservation and Natural Resources projects supply and demand for recreational facilities in Elko County for the years 1990, 1995 and 2000. The Statewide Comprehensive Outdoor Recreation Plan indicated that supply exceeded demand for tent camping sites, picnic tables and swimming. A moderate increase in baseball and softball fields, golf courses and tennis courts would be required by the year 2000. The demand for fishing, biking trails, crosscountry ski trail and hiking/backpacking trails exceeded the supply for all years. The projected supply and demand were unchanged in the most recent Statewide Comprehensive Outdoor Recreation Plan completed in 1992.

Project Area Recreation

Recreation activities do not occur in the project area, which consists of historic and active mining operations. Recreational activities on public lands adjacent to the project area consist of hunting and off road vehicle use. The area is hunted primarily for deer, antelope and upland game birds. Mule deer are the most abundant big game species in the area. Upland game birds include sage grouse, chukar, Hungarian partridge and mourning dove. Hunting on public lands within and adjacent to the South Operations Area has been adversely impacted from past and existing permitted mining operations, which have displaced wildlife from disturbed areas. Consequently, hunting is no longer a major recreational use of these lands.

A watershed restoration project was developed through a cooperative effort among Newmont, BLM, and Elko Land and Livestock Company as mitigation for the 1993 Newmont Mine expansion along Maggie Creek. When the Maggie Creek Conservation Easement is finalized, it would provide access to the private lands along Maggie Creek for research and limited low-impact recreational activities. Public access would be allowed after the Riparian Exclusion and Riparian Restoration Zones have had an adequate period of time to recover from grazing impacts. Public use would be limited to daylight hours, and would consist of light-use activities such as hiking and fishing. Motor vehicles, bicycles, and campfires would be prohibited. Horses,

TABLE 3-28
ANNUAL VISITS TO STATE RECREATION AREAS, 1987 - 1997

	1987		1992		1997	
State Recreation Area	Visits	Percent Change	Visits	Percent Change	Visits	Percent Change
South Fork	na	-	88,466	na	100,668	13.8
Wild Horse	14,912	-	13,162	-11.7	21,696	64.8

dogs, and hunting would be allowed on a TS Ranch-issued permit basis.

VISUAL RESOURCES

The study area for visual resources is an area roughly 20 by 30 miles centered roughly 5 miles northwest of Carlin, Nevada. The landscape of the study area is characterized by broad, open vistas with scattered mountain ranges. The project area is located on gently rolling terrain east of the Tuscarora Mountains, which rise abruptly to over 7,500 feet. The broad, flat valley bottoms of Maggie and Susie creeks lie to the east of the South Operations Area. The landscape was described in detail in the original EIS (BLM, 1993).

The South Operations Area facilities create moderate contrasts to the characteristic landscape with horizontal lines, smooth surfaced blocky and pyramidal forms, and lighter colors from disturbed soil and rock. When weather conditions are calm, black smoke from diesel-powered equipment is often visible above the mine site. During cooler weather, steam plumes may be seen rising from the roaster plant and the cooling towers. Visibility is greatest in the morning when the project facilities are front-lighted.

The viewshed for the project is bounded on the west by the Tuscarora Mountains and to the north by Schroeder Mountain and the hills extending east of Maggie Creek. However, the project has a more extensive viewshed to the south and southeast, as shown in **Figure 3-14**.

The project site is visible to motorists from three locations along Interstate 80. Two of these locations are in the vicinity of the Carlin East interchange and the other is just east of the Carlin West interchange. Motorists near the Carlin East interchange can see the South Operations Area for approximately 60 seconds when driving at 75 miles per hour. Views of the project site are most noticeable to westbound travelers. Other visual features within the Interstate 80 corridor include urban development (e.g., buildings, signs, parking areas, and commercial facilities), highway and railroad cuts and embankments, and powerlines.

The project site is not directly visible from the town of Carlin due to a low ridge north of town. Visibility of the project site is limited along State Highway 766 for a distance of about 3.5 miles northwest of Carlin due to a low ridge. Under certain meteorological conditions, project lighting can cause a glow in the night sky that is visible from Carlin.

The BLM has developed the Visual Resource Management system to classify visual resources based on scenic quality, visual sensitivity, and visual distance zones. Most lands in the study area are assigned to Class III and IV (**Figure 3-15**). Of the four Visual Resource Management classes, Class IV allows the greatest modification of the

landscape by disturbance or development (BLM, 1986).

Most of the project area is located in Class IV lands. Class III lands which include the Tuscarora Mountains are located immediately west of the project area. A 3-mile-wide low-visibility corridor along Interstate 80 has been designated and is managed as Class II, reflecting the visual sensitivity of a relatively high number of motorists. Class objectives are:

Class II: The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the character landscape.

Class III: The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant features of the characteristic landscape.

Class IV: The objective of this class is to provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. The impacts of these activities should be minimized through careful location, minimal disturbance and repetition of the basic elements.

Class Boundaries Visual resource contrast ratings (BLM, 1986) were established for the existing South Operations Area Project. These ratings characterize the visual quality of the landscape based on basic design elements of form, line, color, and texture and allow visual contrast ratings to be made between the existing environment and the proposed action. Visual contrast ratings are based on the premise that the visual quality of a landscape depends on the visual contrast created between a project and the existing landscape.

Key observation points (KOPs) were used for evaluating visual contrasts. Factors considered in selecting KOPs included angle of observation, number of viewers, duration of view, relative apparent size of the project, season of use, and lighting conditions (BLM, 1986). Two of the three KOPs were established in 1993 (BLM, 1993) and one new KOP was established in 1997. KOPs were selected to represent locations on roads approaching the project site from which a person may be expected to view project features. Three KOPs were evaluated (two were existing and one was new). Locations of the KOPs are shown in **Figure 3-15**. **Appendix A** contains Visual Contrast Rating worksheets for KOPs 1, 4, and 6. KOPs 2, 3, and 5 were not analyzed for the SOAPA project. KOPs 2 and 5 are north of Schroeder Mountain which prevents any views of the proposed disturbed areas, and KOP 3 has difficult access to its location high on Marys Mountain and is not considered representative for very many viewers.

KOP 1 is located along Interstate 80, a Class II managed area, and represents the view seen by travelers through the region. This KOP is slightly lower than the project site and is approximately 5 miles away. Visibility is greatest during the morning hours when the project site is front-lighted and smoke from diesel-powered equipment is more likely. KOP 1 is located at a point where westbound travelers are beginning a view of approximately 60 seconds when traveling at 75 miles per hour. Visual contrasts are

LEGEND

- Project Boundary
- County Boundary
- Interstate Highway
- Primary Road
- Secondary Road
- Existing Pipeline
- River/Stream
- Areas Seen From Observer Point

NORTH

1 0 1 2 Miles

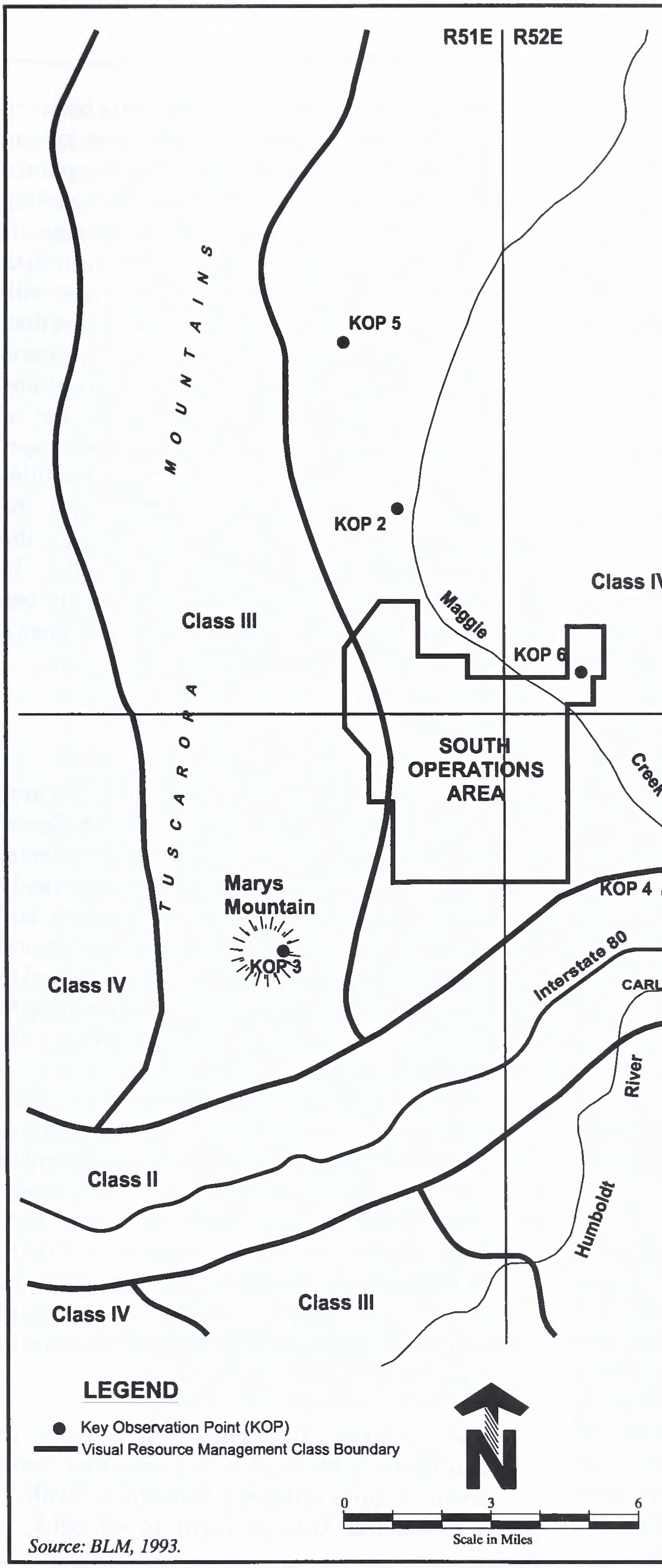
1 0 1 2 3 Kilometers

Transverse Mercator Projection
1927 North American Datum
Zone 11

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-14
PROJECT VIEWSHED

MINE AREA: SOUTH AREA	
DATE: 3/31/99	ARCVIEW FILE: NEWMONT
SCALE: AS NOTED	DRAWN BY: BN



Source: BLM, 1993.

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-15
VRM CLASS BOUNDARIES

MINE AREA: SOUTH AREA	
DATE: 7/6/00	ACAD FILE: Fig3-15.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY DS

moderate when the project site is front-lighted or when diesel smoke is visible. The characteristic landscape is flat to rolling, with angular forms presented by urban development in the foreground-middleground zone and existing mine facilities at the boundary between middleground and the background zone. Horizontal and weak diagonal lines are stronger in the afternoon due to lighting conditions. Exposed soil colors are chalky buff and reddish tan, with vegetation colors ranging from gray-green in the foreground to gray, tan, buff, and yellowish tan in the background. Textures are generally subtle.

KOP 4 is located west of the junction of the former Carlin landfill access road with State Highway 766. This view represents that of commuters and local residents on State Highway 766. KOP 4 affords a horizontal view of the project site, approximately 2½ miles away. While this KOP is located within the Class II highway corridor, it is visually separated from the highway by a low ridge north of Carlin. Views are primarily to the northeast, north, and northwest, with the mine in the middleground to the northwest. The angular, geometric forms and horizontal lines of the existing mine facilities contrast moderately with the flat to rolling forms and horizontal lines of the characteristic landscape. Patchy color patterns, including dark grays and pastel reds, contrast strongly with the chalky buff and gray-green of the characteristic landscape.

KOP 6 is located on private land on the access road from the cooling towers to the Maggie Creek Ranch reservoir. The road also provides access to public lands immediately north of the reservoir. KOP 6 affords a horizontal view of the project site from an elevation approximately 100 feet above the valley floor and approximately two miles east of the project site. KOP 6 represents the view of a back-country or off-road recreationist traveling on BLM roads in the hills between Maggie Creek and Susie Creek after having gained entry from a few limited access points. The view is similar to that of persons traveling on Highway 766, however, its location is farther away and at a higher elevation than Highway 766, thus providing a view with mine facilities in the middleground rather than in the foreground. The angular, geometric forms and horizontal lines of the existing mine facilities contrast strongly with the flat to rolling forms of the characteristic landscape. Patchy color patterns of the mine facilities contrast moderately to strongly with the chalky buff, and orange-tan of the characteristic fall/winter colors. In spring/summer, green vegetative colors can contrast strongly with the tan and brown colors of the mine facilities.

NOISE

The study area for noise concerns is the area inside a line 50 feet outside of the amendment area boundary. Discussions of environmental noise do not focus on pure tones. Commonly heard sounds have complex frequency and pressure characteristics. Accordingly, sound measurement equipment has been designed to account for the sensitivity of human hearing to different frequencies. Correction factors for adjusting actual sound pressure levels to correspond with human hearing have been determined experimentally. For measuring noise in ordinary environments, A-Weighted correction factors are employed. The filter de-emphasizes the very low and very high frequencies of sound in a manner similar to the response of the human ear. Therefore, the A-weighted decibel (dBA) is a good correlation to a human's subjective reaction to noise.

The following discussion sets a basis of familiarity with known and common noise levels. A quiet whisper at five feet is 20 dBA; a residential area at night is 40 dBA; a

residential area during the day is 50 dBA; a large and busy department store is 60 dBA; a typical construction site is 80 dBA; a freight train at 50 feet is 90 dBA; and a jet takeoff at 200 feet is 120 dBA.

The Occupational Safety and Health Administration has established 90 dBA as a permissible noise exposure for an eight-hour period (Marsh, 1991). This limit is below the level of 130 dBA recognized as the noise related to the threshold of pain.

The overall noise level at the South Operations Area is a combination of noise produced by many sources to include blasting, bulldozers, dumping and loading ore and waste rock, trucks, crushers and milling operations. Typical noise levels associated with these sources are shown in **Table 3-29**.

Noise generated on the mine site was estimated from 85 to 100 dBA excluding blasting (BLM, 1993). Because the overall noise is the logarithmic summation of all noise sources, the overall noise of the mine site is estimated to be 107 dBA at a distance 50 feet from operating mining equipment. For an area source, the noise at a distance from the area can be estimated (Bell, 1982) by the relationship:

$$L_2 = L_1 - 10 \log (R_2/R_1)$$

where:

L_2 = noise level at the center of the area;
L_1 =noise level measured at a distance;
R_1 = from the center of the area; and
R_2 = distance from the center of the area where noise is estimated.

This relationship holds for a distance of approximately ½ mile from the edge of the area. Beyond 0.5 mile, noise can be calculated by the relationship:

$$L_2 = L_1 - 20 \log (R_2/R_1)$$

Using these noise propagation equations and using the dimensions of the mine to be approximately a 5-mile square, the noise surrounding the study area can be estimated as shown on **Figure 3-16**.

LAND USE AND ACCESS

The study area for the general description of land ownership and land use is Elko County and the northern portions of Eureka and Lander counties. The general region includes the area within approximately 50 miles of the project area. The analysis focuses on the project area, which consists of BLM lands and private lands in Elko and Eureka counties.

Land Ownership

Land ownership within and adjoining the project area consists of a checkerboard pattern of BLM-administered public and private lands. The total project area comprises 11,636 acres, most of which is located in Eureka County. Land ownership in the project area is shown in **Figure 2-1**. The project area includes all or part of Sections 25-28, 33-36, T34N, R51E; Sections 1-4, 10-15, T33N, R51E; Sections 29, 31, 32, T34N, R52E; and Sections 6, 7, and 18, T33N, R52E in Eureka and Elko counties, Nevada.

Land Use

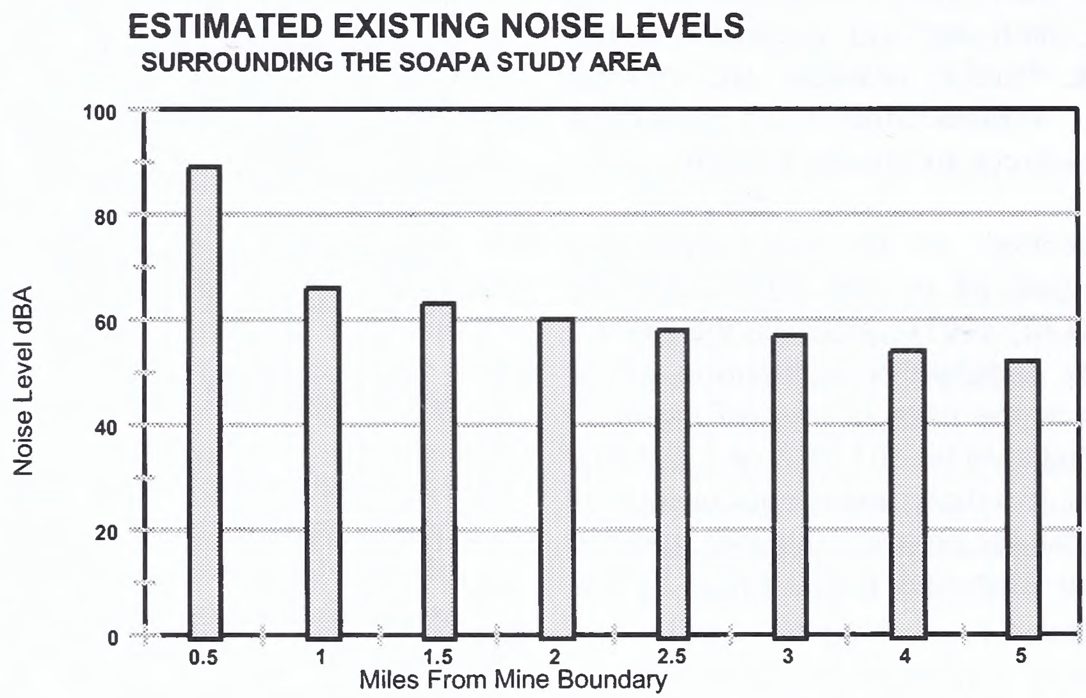
The primary land use on public and private lands in the project area consists of the existing Newmont mine operations. There is

TABLE 3-29
NOISE LEVELS OF MINING EQUIPMENT AND OPERATIONS

Equipment/ Operation	Noise Level (dBA)
Blasting	115-125 dBA at 900 feet
Crusher	95 dBA at source
Haul Trucks	90 dBA at 50 feet
Loaders	87 dBA at 50 feet
Blasthole Drilling	86 dBA at 50 feet
Bulldozers	85 dBA at 50 feet

Source: BLM, 1993.

FIGURE 3-16



a total of 7,960 acres of existing and approved disturbance on public and private lands in the South Operations Area. Most of the existing mining facilities and operations are on private land owned by Newmont. There are 5,913 acres of existing and approved surface disturbance on private lands. Approximately 2,047 acres of facilities consisting of waste rock dumps, mining pits, tailing impoundments, heap leach and bioleach facilities, and other facilities extend onto public lands. Other land uses adjacent to mine facilities include grazing, recreation, and wildlife habitat.

One federal oil and gas lease exists within the project area (N-53873). Public lands in the project area remain open for mineral entry for oil and gas and other minerals. Four utility and road rights-of-way were identified on public lands in the project area. Elko 1655 is an aerial telephone line granted to Nevada Bell. NEV 067173 is a state highway right-of-way permit granted by the Nevada Department

of Transportation for State Highway 766. A powerline and a pipeline in right-of-way N-46404 granted to Newmont provide electricity and water to the South Operations Area. The Sierra Pacific Powerline right-of-way (N-47775) is a 120-kV distribution line that crosses through the northern portion of the project area, and right-of-way (56093) is for another powerline traversing the site. Wells Rural Electric also has a powerline grant on the site.

Access

The project area is approximately six miles north of Carlin on State Highway 766. The highway is parallel to Maggie Creek on private and BLM administered public lands between the project area and its intersection with Interstate 80 on the north side of the town of Carlin. The primary access into the project area is on a private road that connects with State Highway 766 in Section 31, T34N, R52E. The private road is gated and closed to public access.

The Nevada Department of Transportation (1997) has established a counting station on State Highway 766 north of Carlin. The most recent 1996 average daily traffic counts at the station were 1,434 vehicles in the northbound lane and 1,488 vehicles in the southbound lane. Peak periods occurred at 5:00 to 7:00am in the northbound lane and 3:00 to 5:00pm in the southbound lane, reflecting worker commutes between Carlin and the mine. The counts at the station differed between the north bound and southbound lanes because it is probable that the traffic includes people who are not commuting between Carlin and the mine, but who accessed the southbound lane from State Highway 226, or private residences along State Highway 766, and did not make a return trip in the northbound lane.

There are numerous two-track and four-wheel drive BLM roads adjacent to the project area. BLM roads within and connecting to the project area include roads #1238, #1239, #1388, and #1392. Areas to the north of the project area are accessed by BLM roads #1237 and #1391. Roads #1392, #1393 and #1394 access areas to the east of the project area.

BLM Road #1238 formerly crossed through the mine area along James Creek. Public access to road #1238 is now blocked by mine facilities in T33N, R51E. BLM Road #1239 approaches the project area from the southeast, and is now blocked by the mine at Section 7, T33N, R52E. These roads are fenced to prevent access for safety reasons.

Many of the roads on public lands in the project area resulted from historic mineral exploration and mine development, and are currently used for access to grazing allotments, or are utilized by hunters, campers or other recreationists. BLM roads identified on the BLM Transportation Map may not provide legal access even though they provide physical access.

Land Use Planning and Management

BLM Land and Resource Management Plan

The Elko Field Office of the BLM administers the public lands in the project area. General management guidance is to manage public land under the principles of multiple-use and sustained-yield (BLM, 1987). Newmont's Proposed Action is in conformance with the Elko Field Office Resource Management Plan-Minerals Management Prescription.

County Land Use Planning

Land use controls for private lands include county plans and zoning ordinances. In Eureka County, land use is managed through the Eureka County Master Plan and the county zoning ordinance.

Elko County plans to update the current land use plan for the County, which was adopted in 1971. The Elko County Commissioners have adopted an interim land use plan, the Elko County Federal Land Use Plan.

CULTURAL RESOURCES

Cultural resources are known to exist within the South Operations Area (**Figure 3-17**) and were documented by the BLM (1993). The study area for cultural resources is the same as the amendment area.

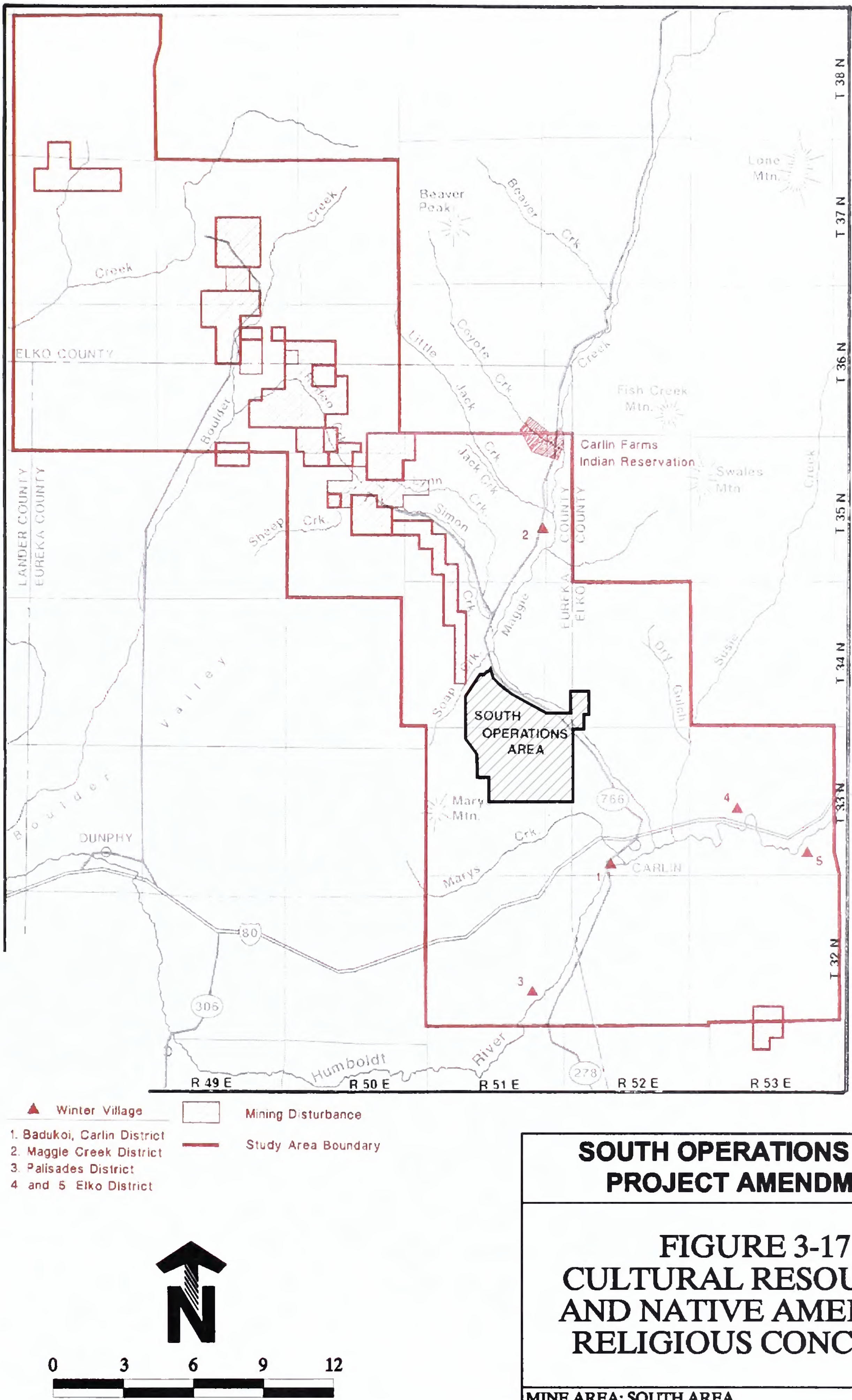
Several overviews of the regional prehistory have been completed in the past 20 years (BLM, 1993). In many ways, these studies update the earlier overview of prehistory by James (1981). The cultural history of the Great Basin was summarized by the BLM (1993).

An intensive cultural resource inventory of four parcels was recently conducted to complete the cultural resource inventory of all previously unsurveyed areas in the South Operations Area Project existing facilities and proposed actions (Newsome and Tipps, 1997 - report BLM 1-1651(P)). A literature review and summary of previous investigations are presented in that document and are summarized here. The latter survey covered 3,125 acres in four parcels in the project area. The files search conducted for the project area (Newsome and Tipps, 1997) indicated that 9 previous investigations had included portions of the project area (included in **Table 3-30**).

The earlier investigations documented two prehistoric sites (CRNV-12-3283 and CRNV-12-8325) within the project area. Both of the latter sites were revisited, documentation was updated, and they were re-evaluated for National Register eligibility. The investigation divided previously recorded site CRNV-12-3283 into three discrete sites (CRNV-12-3283, CRNV-11-9298, and CRNV-11-9299), and recorded 12 previously undocumented prehistoric sites, one historic site, and seven isolated finds (Newsome and Tipps, 1997).

One of the previously recorded prehistoric sites (CRNV-12-3283) and three newly documented prehistoric sites (CRNV-11-9292, CRNV-11-9293, and CRNV-11-9294) were determined eligible for the National Register by the BLM, and three sites were unevaluated (CRNV-11-9279, CRNV-11-9290, and CRNV-11-9291). The remaining ten sites and seven isolated finds were determined by the BLM to be non-significant and not eligible for the National Register. The Nevada State Historic Preservation Officer (1997) concurred with these determinations. Avoidance and protection were recommended for the eligible and unevaluated properties. If these properties cannot be avoided, data recovery plans will be prepared in consultation with the BLM and the Nevada State Historic Preservation Office to mitigate the adverse impacts to the information potential of the resources. It is recommended that data recovery plans for the unevaluated sites include an evaluative testing phase to define the nature and extent of significant data classes and, if necessary, refine the data recovery plan.

Table 3-30 presents a summary of all previous cultural resource investigations in the project area. With the completion of the amendment area inventory (Newsome and Tipps, 1997) the entire project area and amendment area, excluding several small areas of extensive mining disturbance predating systematic



Source: BLM, 1993.

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-17 CULTURAL RESOURCES AND NATIVE AMERICAN RELIGIOUS CONCERNS

MINE AREA: SOUTH AREA	
DATE: 6/6/00	ACAD FILE: Fig3-17.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY DS

TABLE 3-30
CULTURAL RESOURCE INVESTIGATIONS COMPLETED IN THE SOAPA STUDY AREA, PROJECT AREA, AND AMENDMENT AREA

BLM Report #	Author(s) date (block or linear)	Acres (in SOAP)	Sites Found	Sites Revisited	Eligible
1-330(N)	Nelson, 1980 (linear)	0.75	0	0	0
1-642(P)	Gallagher et al., 1982 (linear)	274 (23)	0	0	0
1-682(P)*	Clerico, 1983 (block)	1760	15	0	0
1-727(P)	Clerico et al., 1983 (n/a)	(testing)	0	6	1
1-967(P)	Matranga, 1985 (linear)	330	1	0	0
1-1126(P)*	Johnson, 1987 (linear)	260	0	0	0
1-1324(P)	Popek and Strand, 1990 (block)	640	0	0	0
1-1340(P)	Popek and Schroedl, 1990 (block)	640	3	0	0
1-1341(P)	Tipps et al., 1990 (block)	1276	8	0	0
1-1403(P)	Lennon and Peterson, 1991 (block)	1930	1	0	0
1-1480(P)*	Brewster, 1990 (linear and block)	1	1	0	0
1-1501(P)	Hause, 1991 (linear and block)	60	0	0	0
1-1505(N)*	Popek and Tipps, 1991 (linear)	38	0	0	0
1-1584(P)	Elston and Budy, 1990 (n/a)	(data recovery)	0	1	1
1-1640(P)	Newsome, 1992 (block)	505	2	0	0
1-1722(P)*	Kice, 1993 (linear and block)	756	6	0	1
1-1725(P)	Newsome, 1993 (linear and block)	1051	8	0	3
1-1746(P)*	Tipps and Newsome, 1993 (block)	82	0	0	0
1-1788(P)*	Kautz, 1993 (linear)	860	16	0	0
1-1807(P)	Kenzle, 1993 (linear and block)	300	5	0	0
1-1888(N)*	Kenzle, 1994 (linear)	3	0	0	0
1-1905(P)*	Newsome, 1994a (linear and block)	130	2	0	0
1-1926(N)	Newsome, 1994b (linear and block)	56	0	0	0
(not BLM)	Schroedl, 1994 (block)	?	6	0	0
1-1651(P)	Newsome and Tipps, 1997 (block)	3125	13	4	4

*These previous investigations included portions of the Amendment Area, Report #1-1651(P).

cultural resource investigations, have been inventoried for cultural resources.

There have been 25 previous cultural resource investigations in the South Operations Area Project, including the recent P-III investigation. These investigations are briefly summarized in Newsome and Tipps, (1997). The previous investigations ranged in size from an acre or less for exploratory cores and telephone cables to the recent survey of over 3000 acres, as well as testing and data recovery investigations at James Creek Shelter. The previous investigations included two excavation projects at James Creek Shelter, nine block area inventories, seven linear corridor inventories, and seven combined linear and block inventories (e.g., block area and access corridor). Several of the larger investigations were predominantly outside the South Operations Area Project. Cultural resource inventories have documented 47 cultural resource sites and 34 isolated finds. The sites included 43 prehistoric open lithic scatters, two of which also contained historic materials, one prehistoric sheltered camp (James Creek Shelter), two historic fences or corrals, a mining complex, and a scatter of early mining-related debris (interpreted as a mining camp). The isolated finds included 24 isolated prehistoric artifacts and eleven historic isolated finds. Thirty-three (77 percent) of the prehistoric lithic scatters were small or sparse scatters containing fewer than 100 artifacts, predominantly chipped stone debitage. Diagnostic artifacts were found at 15 of the sites, five of which had more than one component represented. A total of 21 prehistoric components was identified on the basis of diagnostic artifacts. These included one Early Archaic, six South Fork Phase, five James Creek Phase, five Maggie Creek Phase, and four Eagle Rock Phase. Several of these component identifications are only tentative, because the projectile point type is known to be associated with more than one phase. The remaining 28 prehistoric lithic scatters could not be associated with a discrete prehistoric period or cultural group.

Five of the prehistoric sites were evaluated as having significant information potential and were determined eligible for the National Register (**Table 3-31**). Three of the prehistoric sites were evaluated as having the potential to yield important data classes from buried contexts, and were determined as unevaluated for the National Register pending subsurface testing. One of the eligible sites was James Creek Shelter (CRNV-12-3320/26EU843). Data recovery investigations have already been completed at James Creek Shelter, and the site is within the Gold Quarry pit. Even though the site has been destroyed, it has made lasting contributions to regional chronology and our understanding of the prehistory of north-central Nevada, and remains a National Register site. The remaining seven eligible and unevaluated sites should be treated as significant historic properties. If these sites cannot be avoided by future mining developments, data recovery plans will be prepared in consultation with the BLM and the State Historic Preservation Office.

NATIVE AMERICAN RELIGIOUS CONCERNS

Previous consultation with members of the Newe/Western Shoshone community was documented in BLM (1993) and was also documented in a report entitled *Consultation With The Western Shoshone Regarding the Proposed Expansion of Newmont Gold Quarry Mine, Carlin, Nevada* (Deaver, 1993).

Since general ethnographic inquiry tends to be broad in scope, the BLM (1993) addressed ethnographic issues relevant to both the area of direct effect and the area of cumulative

TABLE 3-31
ELIGIBLE AND UNEVALUATED CULTURAL RESOURCE SITES IN THE SOAPA AREA, PROJECT AREA, AND AMENDMENT AREA

BLM Site #	SITE #	Site Type	Report #	Action	Evaluation
CRNV-12-3320	26EU843	sheltered camp (James Creek shelter)	1-682(P)	mitigated	eligible
CRNV-12-3283		lithic scatter	1-682(P) and 1-1651(P)	avoid/mitigate	eligible
CRNV-11-9292		lithic scatter with groundstone	1-1651(P)	avoid/mitigate	eligible
CRNV-11-9293		lithic scatter with groundstone	1-1651(P)	avoid/mitigate	eligible
CRNV-11-9294		lithic scatter	1-1651(P)	avoid/mitigate	eligible
CRNV-11-9279		lithic scatter with groundstone	1-1651(P)	avoid/test	unevaluated
CRNV-11-9290		lithic scatter	1-1651(P)	avoid/test	unevaluated
CRNV-11-9291		lithic scatter	1-1651(P)	avoid/test	unevaluated

effect. Consequently, neither the area of direct effect nor the area of cumulative effect was discussed individually. Discussion of the Newe/Western Shoshone history and world-view was presented in BLM (1993).

Based on the consultation conducted in 1993, the following statements characterize the general concerns of Newe/Western Shoshone traditionalists as they pertain to mining activities:

1. Ground-disturbing activities associated with mining can disrupt the flow of spiritual power (Puha) as well as the distribution or disposition of spirits (e.g., Little Men and Water Babies). Maintaining access to undisturbed concentrations of Puha (power spots) and continuing relationships with the spirits is integral to spiritual life.

2. Dewatering efforts, with the resultant reduction or loss of flow to springs, could alter the distribution or disposition of spirits associated with water. Maintaining a relationship with these spirits is integral to spiritual life. Spring water is also used as a sacrament, medicinally, for drinking,in prayer, etc. In addition, some springs are a source of sacred white clay, and burials often take place near these springs.

3. Ground disturbance results in the loss of plants and minerals and used by Western Shoshone traditionalists.

4. Cultural resource inventories conducted by archaeologists prior to mining activities often result in collection of artifacts that Western Shoshone traditionalists consider to be powerful and sacred objects (e.g., complete projectile points and items of Tosawihi chert). Current curation practices can prevent traditionalists from securing these items for use in healing practices, etc.

Additional consultation for the proposed South Operations Area Project Amendment has occurred in two phases. Phase I was initiated via certified letter on May 22, 1997. The Te-Moak Tribe, Elko Band Council, Battle Mountain Band Council, Wells Band Council, Southfork Band Council, and the Western Shoshone Historic Preservation Society were invited to discuss the potential effects of ground-disturbing activities associated with the SOAPA on areas of cultural or religious importance to the Shoshone people. The South Fork Band Council sent a response to the BLM indicating that they had no concerns or comments about the proposed project. The BLM did not receive a response from the other tribal and band entities, nor from the Western Shoshone Historic Preservation Society. Thus, on June 16, 1997, the BLM called those which did not respond to the initial consultation letter and again invited comments on the project. As a result of these calls, the BLM received a response from the Western Shoshone Historic Preservation Society. The Western Shoshone Historic Preservation Society indicated that the lands which encompass the mine were owned not by the federal government but by the Western Shoshone people, and that the Western Shoshone Historic Preservation Society did not approve of the project. No specific comments were offered, and no specific areas of cultural or religious significance to the Western Shoshone people were revealed. On August 25, 1997, the BLM sent certified letters to the Te-Moak Tribe, Wells Band, Battle Mountain Band, and Elko Band stating that the BLM had not received a response from them for the past 90 days. The letter stated that, as a result of not receiving a response, the BLM intended to consider consultation complete for the proposed project, and that the tribe and bands had no comment. The BLM received no comments as a result of the letter.

Phase II of the current consultation effort involved the cumulative environmental impacts of mine dewatering at Newmont's Gold Quarry and proposed Leeville operations, together with Barrick's Betze operation. Consultation on the cumulative effects of mine dewatering on Western Shoshone culture and religion was initiated on October 1, 1998, and is currently ongoing. Please see the "Native American Religious Concerns" section of the technical document entitled "Cumulative Impact Analysis of Dewatering Operations for Betze Project, South Operations Area Project Amendment and Leeville Project" for details of this consultation effort. However, the main findings of this consultation effort to date are briefly described below.

The consultation for mine dewatering resulted in the identification of two Traditional Cultural Properties (TCPs), one along Rock Creek and one at the Tosawihi Quarries. The BLM determined that the Rock Creek area was eligible for the National Register as a TCP under criteria a, c, and d, and the Tosawihi Quarries area was eligible for the National Register as a TCP under critieria a and d. In a letter dated May 19, 1999, the Nevada State Historic Preservation Office concurred with the BLM's determinations. In addition to the TCPs, the Western Shoshone expressed concern about the declining numbers of sage grouse, and the overall impact of the loss of native plants and animals, as well as water resources, on their traditional cultural practices.

SOCIAL AND ECONOMIC RESOURCES

The socioeconomic study area for this project encompasses Elko and Eureka counties and the communities of Elko, Carlin, and Spring Creek, and the Elko Band Colony. The geographic scope of this coverage is defined

primarily by the economic reach of existing mining operations. These communities have been selected because they represent the primary areas of residence of existing Newmont employees. Because the South Operations Area Project is located in Eureka County which will continue to receive tax revenues with continued mining operations, it has also been included in the study area.

Most of the workers employed by Newmont and their families do not reside in Eureka County due to long commuting distances between the mine and Eureka County communities. Information related to public finance in Eureka County is presented in this analysis, however, social and public utility and service information is not included because of the negligible impact anticipated in these areas as a result of this project.

The EIS prepared in 1993 (BLM, 1993) described the social history and attitudes toward social well-being in Elko County. The following paragraphs present baseline information related to population, labor and employment, housing, public utilities and services, public finance, energy, and environmental justice. The discussion attempts to focus on elements that have changed over the past five years.

Population

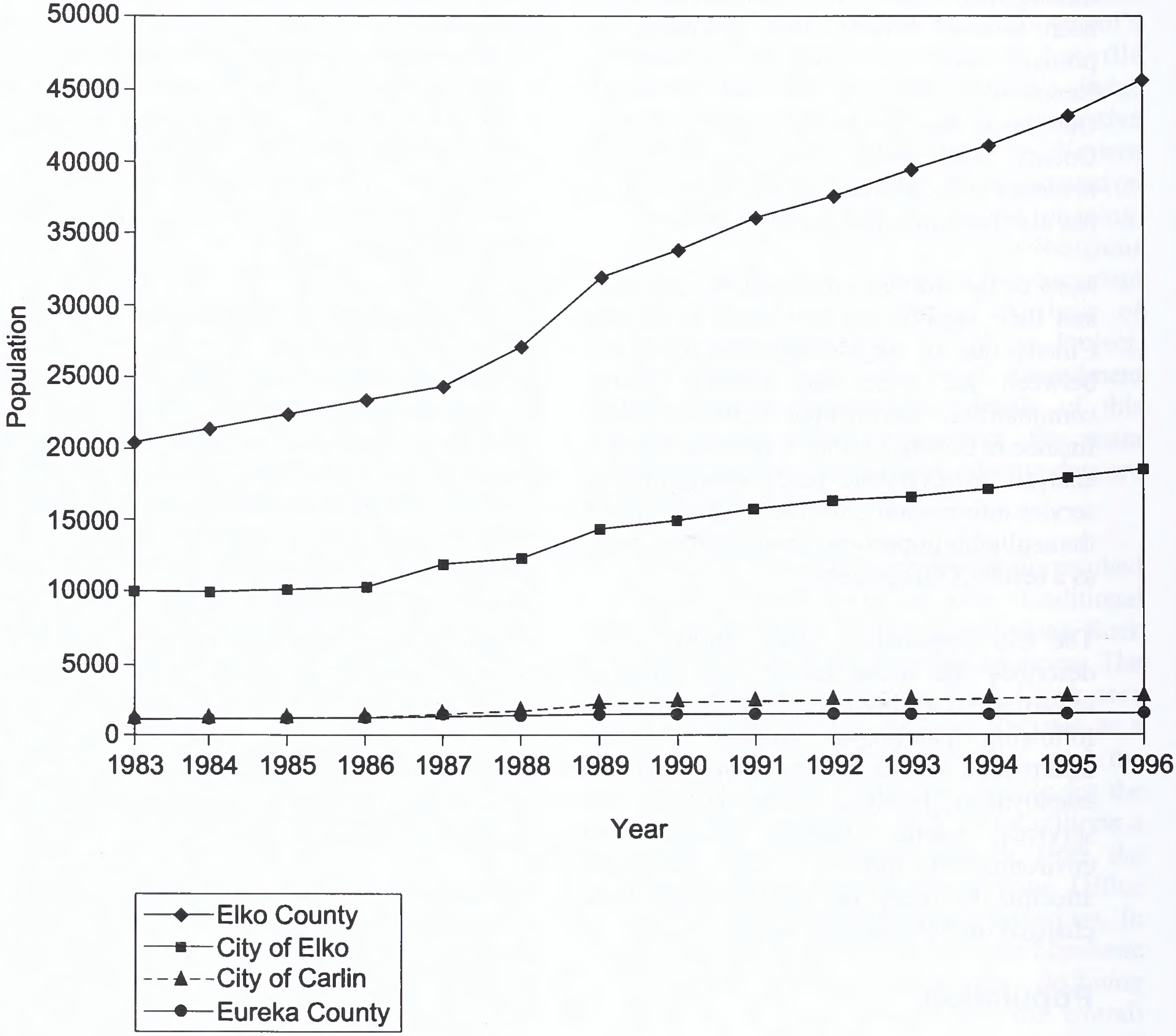
Nevada's population grew from 800,508 in 1980 to 1,688,600 in 1996, an increase of 888,092 individuals, an approximate 111 percent increase. The majority of this increase can be attributed to in-migration associated with jobs generated by the gambling-related service sector, mining industry, and construction sector.

Elko County has experienced a tremendous growth in population over the last 10-15 years. Much of the population growth in Elko County has been concentrated in Carlin and Elko and is primarily attributable to exploration and mining activity in the area. According to Nevada Department of Taxation, the population of Elko County increased from 33,770 in 1990 to 43,630 in 1996, an increase of 30 percent. The City of Elko had a population of 14,950 in July 1990 and 18,570 in July 1996, a 24 percent increase over the 6-year period.

The communities of Carlin and Spring Creek have also experienced substantial growth. Between 1990 and 1996, the population of the City of Carlin experienced 12 percent growth from 2,410 in 1990 to 2,710 in 1996. Spring Creek grew from a population of 5,866 in 1990 to 10,820 in 1995, an absolute increase of 84 percent. Demographic characteristics of Carlin differ slightly from Elko County, Elko, and Spring Creek. Carlin has a higher percentage of males, more residents in the 18- to 44-year-old age category, fewer residents 25 years old and older with more than a high school education, and fewer family households. These differences could be due to a larger population of miners in Carlin than in the other communities.

Table 3-32 provides population data for Nevada, Elko County, City of Elko, City of Carlin, community of Spring Creek, Elko Band Colony, and Eureka County. **Figure 3-18** displays the population growth trend for Eureka County, Elko County, and the cities of Elko and Carlin.

Nevada's population is projected to continue its upward growth trend, increasing by as much as 42 percent between 1995 and 2015, leading to a statewide population of 2,179,000. Similarly, Elko County is projected to grow in population, reaching 64,467 people in 2016, a 41 percent increase over the 1996 population.



Source: *Nevada Department of Taxation, 1997a.*

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-18
POPULATION TREND

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TABLE 3-32
POPULATION CENSUS DATA AND POPULATION ESTIMATES

	1980[1]	1986	1990	1992	1994	1995	1996
Nevada	800,508	993,220	1,236,130	1,343,940	1,494,230	1,582,390	1,688,600
Elko County	17,269	23,320	33,770	37,420	41,050	43,050	45,630
City of Elko	8,771	10,320	14,950	16,270	17,110	18,000	18,570
City of Carlin	1,233	1,350	2,410	2,240	2,470	2,690	2,710
Spring Creek	2,002	na	5,866	na	na	10,820[2]	na
Elko Band Colony	na	519[3]	1,158[3]	na	na	1,326[4]	na
Eureka County	1,198	1,330	1,550	1,580	1,550	1,580	1,650

Source: Nevada Department of Taxation and Nevada State Demographer, annual data recorded July 1, 1997a.
[1] provided by U.S. Bureau of the Census, 1991.
[2] provided by Elko County Chamber of Commerce, July 2, 1995.
[3] provided by Bureau of the Census, 1991.
[4] provided by BIA, 1995.
na = not available.

Labor and Employment

Civilian Labor Force

In 1997, employment in the State of Nevada was dominated by service industries, accounting for approximately 42 percent of the state's jobs. Retail and wholesale trade, the next largest employment sector, provided about 19 percent of jobs statewide. Approximately 1.5 percent of jobs statewide were in the mining industry.

In 1997, the largest employment in Elko County was in the service industry sector, employing approximately 40 percent of the county's workers. The trade sector accounted for 19 percent of employment, while government jobs comprised 15.5 percent of the total. Employment data for March 1998 indicates that the mining industry employed 1,220 workers, a decrease of 90 workers (nearly 7 percent) from the 1997 mining employment of 1,310 workers.

The total labor force in Eureka County is 810 workers, which contrasts with the total number of available jobs of 4,850 in the county. This discrepancy occurs because many workers employed in Eureka County,mainly by the Carlin Trend mines, reside in Elko County.

The largest industry sector in Eureka County is mining at 82 percent, with the balance shared between construction, government and trade jobs. **Table 3-33** provides the 2000 employment distribution by industry data for Nevada and Elko and Eureka counties. The labor force distribution data provided in **Table 3-33** is presented graphically in **Figure 3-19**.

Agriculture plays an important role in the economies of Eureka and Elko Counties, and has provided a stable employment and income base in both counties. Agriculture employs a small number of workers relative to other industry sectors, as shown in **Table 3-33,** primarily because of increases in productivity through the use of pivot irrigation systems, which require less labor while achieving

TABLE 3-33
LABOR FORCE DISTRIBUTION BY INDUSTRY, 1997 ANNUAL AVERAGE
NEVADA, ELKO COUNTY AND EUREKA COUNTY

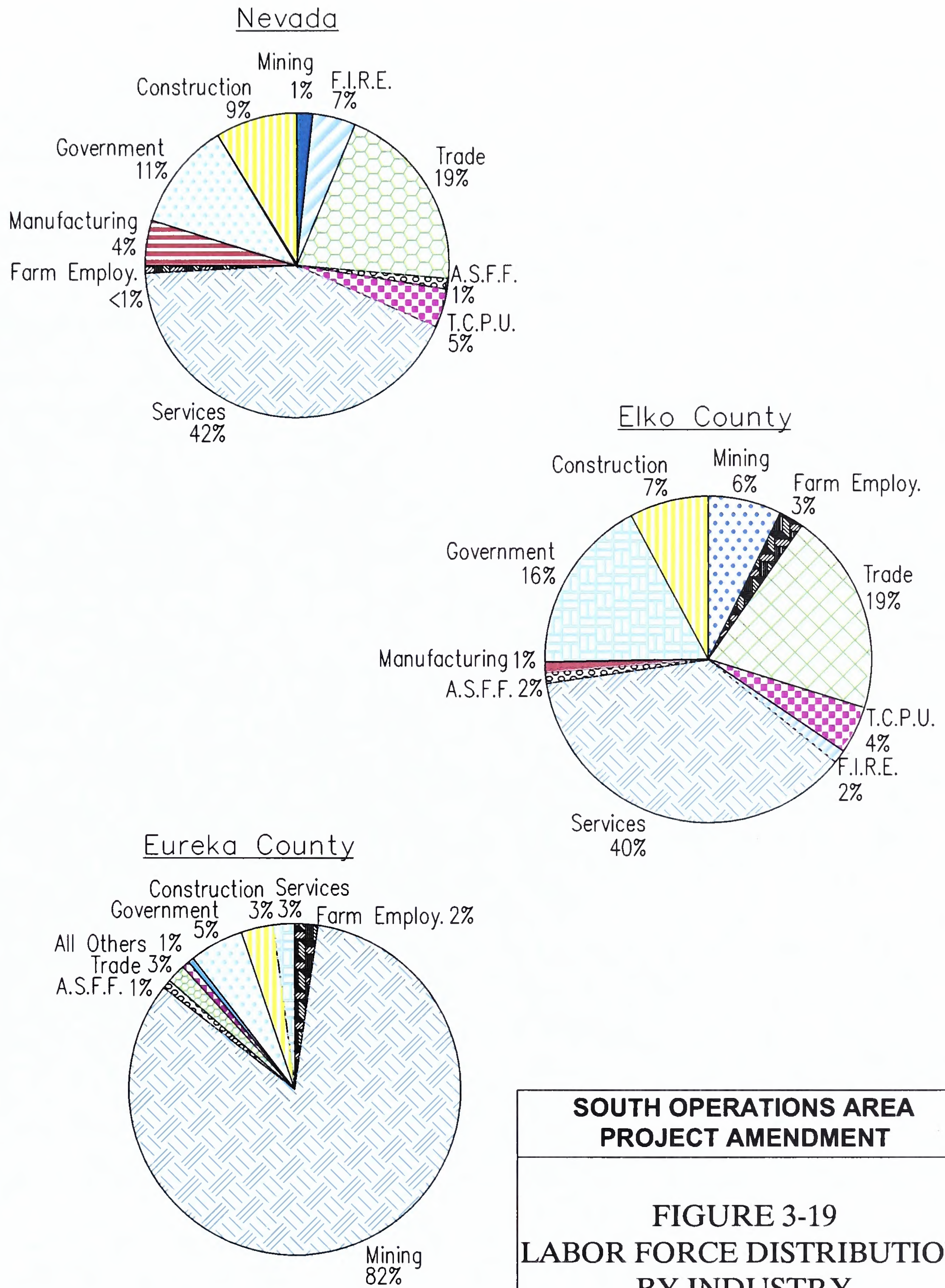
	Nevada		Elko County		Eureka County	
	Number of Jobs	Percent of Total	Number of Jobs	Percent of Total	Number of Jobs	Percent of Total
Farm Employment	4,732	0.43%	814	3.25%	123	2.37%
Non-Farming Employment						
Agri. Serv., Forestry, Fisheries & Other	11,728	1.08%	(D)	0.00%	42	0.81%
Mining	16,051	1.47%	1,485	5.92%	4,276	82.42%
Construction	97,204	8.92%	1,674	6.67%	151	2.91%
Manufacturing	44,166	4.05%	331	1.32%	(L)	0.00%
Transportation & Public Utilities	51,118	4.69%	1,040	4.15%	(L)	0.00%
Wholesale Trade	37,744	3.46%	876	3.49%	(D)	0.00%
Retail Trade	173,938	15.96%	3,879	15.47%	128	2.47%
Finance, Insurance & Real Estate	76,353	7.01%	(D)	0.00%	(D)	0.00%
Services	459,928	42.21%	9,976	39.77%	148	2.85%
Government	116,560	10.70%	3,899	15.55%	275	5.30%
Total Employment	1,089,522	100.00%	25,082	100.00%	5,188	100.00%

(D) Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals.
(L) Less than 10 jobs, but the estimates for this item are included in the totals.
Source: Regional Economic Information System, 2000.

TABLE 3-34
EMPLOYMENT AND UNEMPLOYMENT INFORMATION, 1997

	Total Labor Force	Employment	Unemployed	Unemployment Rate
Nevada	912,600	869,200	43,400	4.4
Elko County	22,050	21,010	1,040	4.7
Eureka County	810	750	60	7.8

Source: Nevada Department of Employment, Training, and Rehabilitation, 1997b.



A.S.F.F. - Agricultural Service, Forestry, Fisheries
T.C.P.U.- Transportation, Communication, Public Utilities
F.I.R.E.- Finance, Insurance, Real Estate

Source: Nevada Department of Employment, Training, and Rehabilitation, 1997b.

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 3-19
LABOR FORCE DISTRIBUTION BY INDUSTRY

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greater productivity. In 1997, cash receipts from the sale of agricultural products totaled more than $13 million in Eureka County and more than $49 million in Elko County. These revenues were generated mostly by the sale of livestock and livestock products. Crops produced in the counties include forage, grains, and alfalfa.

Unemployment

Recent (April through June 1997) employment and unemployment data for Nevada, Elko County, and Eureka County is presented in **Table 3-34**. Nevada's current unemployment rate is 4.4 percent. At 4.7 percent, Elko County's unemployment rate is slightly higher than the State's. Of the 810 workers residing in Eureka County, 7.8 percent are unemployed.

The Elko Band Council, the Te-Moak Tribe, the Te-Moak Housing Authority, the Bureau of Indian Affairs, and the U.S. Indian Health Service are the basic employers of the Elko Band Colony (BLM, 1993). Bureau of Indian Affairs data from 1995, estimates the labor force of Colony at 728 workers, of these 20 are unemployed, representing an unemployment rate of 3 percent (BIA, 1995).

Newmont Employment

Currently, Newmont employs approximately 2,950 people in Nevada, and approximately 1,000 people in the South Operations Area Project (Newmont, 1999a personal communication).

Housing

In the mid-1980s, the availability of housing stock in the Elko County area was extremely limited, and the housing market was considered very tight. This condition was due to a significant increase in mining in the Carlin Trend and subsequent influx of people into the area. The availability of housing was so limited that in some cases people were forced to live in overcrowded conditions, in parked cars on private property, on federal land, in parking lots, and in motels and tents. This situation has subsequently been alleviated and to satisfy the demand for housing, developers responded with increased construction of houses and apartment complexes.

In 1997, there were 15,117 housing units in Elko County, of which about 90 percent were occupied (Elko County Assessor, 1997). In the unincorporated community of Spring Creek, the vacancy rate was 5.6 percent, as there were approximately 2,500 housing units in 1999, with approximately 2,350 occupied units (Ross Realty, 2000). Forty percent of the housing units in the county were one-unit structures, 2 percent were two- to four-unit structures, and 58 percent were "other," including mobile homes. In 1997, there were 900 housing units in Carlin with over 90 percent occupancy (Elko County Assessor, 1997). Carlin had slightly more two-to-four unit structures than Elko, but the one-unit structures and "other" class structures were similar.

Table 3-35 provides current (July 1997) housing statistics by type for Elko County and the Cities of Elko, Carlin, and Spring Creek. Of the total 15,117 housing units in Elko County, 46 percent are single family homes, 40 percent are mobile homes, 12 percent are multifamily units, and 2 percent are agricultural residences. There are currently (1999) 3,261 lots available for all types of housing units in Spring Creek (Elko County Assessor, 1999). Some lots are not developed with a housing unit.

The 1980 census data indicates that the average single-family home for the City of Elko and Elko County was $54,900 and

TABLE 3-35
ELKO COUNTY, TOTAL HOUSING UNITS, JULY 1, 1997

	Property Type						
	Single Family Detached	Single Family Attached	Mobile Homes (Secured and Unsecured)	Multifamily (Total # of Individual Units)	Agricultural Residential	Total	Vacancy Rate
Elko County	6556	400	6001	1803	357	15,117	
City of Elko	3315	308	1524	1187	0	6334	10%
City of Carlin	362	24	476	36	2	900	10%
Spring Creek	N/A	N/A	N/A	N/A	0	1914	5.4%

Source: Elko County Assessor, 1997.

$49,900, respectively. By 1990, home prices increased to $90,000 for the City of Elko, $60,000 for Elko County. Recent 1996 Northeast Nevada Development Authority statistics show the City of Elko average home price as $127,667, and $115,000 for Elko County.

Housing at the Elko Band Colony is fairly limited. There are 221 single-family housing units and a senior/citizens/handicapped apartment complex with 10 apartments. Construction of additional housing at the Colony is not anticipated in the near future (BLM, 1993).

Public Utilities and Services

Schools

Elko County School District provides educational facilities throughout the County. Current enrollment statistics for the major schools within the district are identified in **Table 3-36.**

The District indicates that its future development plans include the installation of a new modular school site in Elko, Nevada providing additional capacity for about 600 students. All new school construction in Nevada takes place on a pay-as-you-go financing plan, with the necessary funds collected from ad valorem taxes prior to construction. Additional financing for capital facilities is provided through a percentage of the mining net proceeds tax (described later) and additional donations from mining companies.

Great Basin College located in Elko is a two-year institution offering Associates' degrees over a wide curriculum of arts, sciences, and applied sciences, and beginning to offer baccalaureate degrees. The initial four-year program is in Elementary Education, and the next requests that will go to the Board of Regents of the University of Nevada System will be for Applied Sciences, Professional Studies, and Nursing. The College is growing rapidly with a current fill-time-equivalent student population of 1,252. The student population has grown at an annualzied rate of 123.6 percent between 1988 and 1998, and the campus has expanded from three to 11 buildings (Mahlberg, 2000).

Education for children in the Elko Band Colony is provided through the Elko County School District. A Headstart Program is

TABLE 3-36
ELKO COUNTY SCHOOL DISTRICT ENROLLMENT STATISTICS

School	Grades	Number of Students Spring 1997	Current Capacity
Elko Grammar No. 2[1]	K-6	562	590
Southside Elementary[1]	K-6	687	820
Northside Elementary[2]	K-6	653	730
Mountain View Elementary[1]	K-6	839	870
Spring Creek Elementary[3]	K-6	808	915
Spring Creek Middle School	6-8	651	750
Spring Creek High	9-12	728	850
Sage Elementary[4]	K-5	563	650
Elko Junior High[5]	7,8	715	750
Elko Senior High	9-12	1252	1,300
Carlin Combined	K-12	552	800
Owyhee Combined	K-12	322	500
Wells Elementary Jr./Sr. High	K-12	463	525
Jackpot	K-12	306	400
West Wendover	K-6	555	500
West Wendover Jr./Sr. High	7-12	316	600

Source: Harris, 1997.
[1] Includes 2 modular units with a capacity of 60 students each.
[2] Includes 3 modular units with a capacity of 60 students each.
[3] Includes 4 modular units with a capacity of 60 students each.
[4] All modular units.
[5] Includes 8 modular units.

housed and operated at the Colony for children between the ages of 3 and 5 and a 5-week summer school for school-aged Indian children operates at the Colony through the Elko County School District. The Elko Band Council, under contract with the Bureau of Indian Affairs, provides higher education and an adult vocational program at the Colony (South Operations Area Project Report).

Law Enforcement

Law enforcement along the state highway system is provided by Nevada Highway Patrol. Law enforcement within the unincorporated portions of Elko County is provided by Elko County Sheriff's Department. The City of Elko Police Department provides law enforcement within the City limits.

The City of Carlin Police Department is accountable for law enforcement within the Carlin city limits, and the Te-Moak Tribe of Western Shoshone Indians are responsible for law enforcement within the Elko Band Colony.

As of 1997, Elko County Sheriff's staffing consisted of 45 sworn sheriff's deputies, (3 of whom are criminal investigators), 17 jail staff, and nine administrative support staff. The department maintains 28 marked patrol vehicles. Jail facilities are provided at the Elko County Jail and provide capacity for 115 inmates. Frequently, the jail is over capacity.

The average inmate count on most nights is 110, with 130-140 inmates on busy weekend nights (Stewart, 1997).

The Elko City Police Department consists of 35 sworn officers, 6 civilians and 10 communications personnel. Staffing levels in 1992 provided for a sworn officer/resident ratio of 1:600 (U.S. Department of Agriculture, 1996). Carlin City Police Department staff consists of 5 officers.

Fire Protection

Fire protection services are provided in the unincorporated areas of Elko and Eureka Counties by the Northeastern Nevada Fire Protection Department. The Department consists of seven paid staff and 27 volunteers. Assistance is also provided by the Nevada Division of Forestry, Bureau of Land Management, and Bureau of Indian Affairs, through mutual aid agreements. In general, the agreements specify that firefighters will assist outside of their respective jurisdictions, but recognize that their own jurisdiction has first priority.

Carlin Fire Department serves the area within the Carlin City limits. The Department maintains 30 volunteers.

Fire protection and emergency medical services within the Elko City limits are provided by the Elko Fire Department. The Department has 15 paid firefighters, 21 volunteers, support staff, and seven pumper vehicles. The department maintains an Insurance Service Organization rating of five. This designation is applied to fire protection service areas for insurance purposes and is based on response times, access, available equipment, and other factors. The rating scale ranges from one to nine, with level one being the best protection and level nine generally applied to the most rural areas with only minimal fire protection services available.

Ambulance

Elko county ambulance operates out of Elko General Hospital. The ambulance is staffed by 32 volunteers (all trained emergency medical technicians). Overall, the area is adequately covered by the existing number of volunteers; however, during special events (e.g., country fair, Basque Days), more volunteers are needed. The ambulance is operated and financed through the County funding and fees for services. The two county ambulances are in good condition. Although there is usually adequate number of ambulances to serve the Elko area, one additional vehicle is required when there are special events (BLM, 1993).

Carlin Ambulance is a city run operation, financed by the city and payment of fees for services. It is staffed by 15 to 20 volunteer emergency medical technicians some with emergency training for mine rescue. Two ambulances are maintained. Due to its proximity to SOAPA, Carlin Ambulance would be the first to respond to emergency requests at the mine. Newmont staffs emergency medical technicians on all shifts at the mine to stabilize patients until the Carlin Ambulance arrives (BLM, 1993).

Health Care

Elko general Hospital provides medical facilities for Elko County. This full-service medical facility consists of 50 beds and a 24 hour emergency room as well as a full range of hospital services. The hospital is currently constructing a new facility and is expanding to 75 beds. It provides obstetrical, surgical, and general medical services and maintains a medical staff of 36 practicing physicians, in a range of specialities, including a registered dietician, respiratory therapist, radiology, lab, ultra sound, nuclear medicine, EEG, ICU and CAT-scan (Elko General Hospital, 2000).

Elko clinic is a fifty-bed acute care hospital with a physical therapy department. The staff consists of 12 practicing physicians, 15 contracted physicians, 1 physician assistant, and 11 registered nurses (Desantner, 2000) the Clinic maintains a full service laboratory and X-ray facility (Desantner, 2000).

The Spring Creek Clinic is a satellite office of Elko clinic. The clinic is currently shut down, and there is no staff. However, in August 2000, a family practice doctor will resume operations at the clinic (Link, 2000).

Indian Health Services/Health Center provides comprehensive medical care at Elko Band Colony. It has a pharmacy, a two-chair dental office with a laboratory, and other support services such as community health nurse, alcohol/drug prevention, and after-care programs (BLM, 1993).

Social Services

Social services are provided by Elko County Human Services and Nevada Welfare Department. Elko County Human Services' General Assistance Program assists with rent, food vouchers, utilities, medical services, and food commodities. Nevada Welfare Department program offers food stamps, Medicaid, Aid to Families with Dependent Children, low-income medical assistance, child protective services, and food supplements to pregnant women and women with infants (BLM, 1993).

The Elko Band Council Program (under contract with the BIA) provides Indian general welfare assistance, adult institutional care, Indian child welfare (including foster care and institutional placements). Indigent burial assistance, counseling services, and assistance with social security benefits, disability benefits, death benefits, and state Medicare and Medicaid benefits. The Council operates two nutritional programs at the Colony, an Elders Nutritional Program and the Summer Food Service Program for Children (BLM, 1993).

Water and Wastewater

Water

The unincorporated areas of Elko County get domestic water from natural springs and domestic wells. The County provides water service management assistance to various water districts and unincorporated towns.

The City of Elko is serviced by 19 wells. The municipal water system has a maximum flow capacity of approximately 17 million gallons per day, with peak summer usage of 12 million gallons per day and low usage in January of 3 million gallons per day. Water is stored in seven storage tanks (four 3-million-gallon tanks, two 1-million-gallon tanks, and one 1.5-million-gallon tank). The City is in the process of adding an additional 3-million-gallon storage tank, which would increase the City's total municipal water storage capacity to 18.5 million gallons (Vega, 1997). The City's water system is managed as an enterprise fund and is supported entirely by service fees.

Carlin is served by one deep well and one spring. The water system is in good condition and has never experienced water shortages. Water is stored in a 2-million-gallon tank. (BLM, 1993). The unincorporated area of Spring Creek, located southeast of Elko, maintains an independent water system for domestic use and fire protection. The system includes eight wells, and is currently being upgraded to increase pumping capacity (Spring Creek Association, 1998).

Wastewater

Elko Wastewater Treatment Facility located west of the city, is a fixed-film biological sewage plant. A fixed film system grows microorganisms on a fixed substrate (film) which absorb organic matter and nutrients from the wastewater. The facility has recently been upgraded to treat 4.5 million gallons per day. A second primary clarifier, a new biotower, and a second secondary clarifier have been added to the system. The 1996 average volume of wastewater treated by the facility was 2.8 million gallons per day. The City is currently in the processes of constructing a new digester to the system (Witmore, 1997).

The Carlin Wastewater Treatment Facility, constructed in 1990 at a cost of $2 million, is designed to serve 5,000 people at full capacity. This facility treats waste in settling ponds and disposes of treated water through a flood irrigation system (BLM, 1993).

Parks and Recreation

Recreational facilities within Elko County are primarily provided by the incorporated municipalities and private groups. One recreational program is funded entirely by a local gold mining company. The County maintains the County Fairgrounds. The city of Elko does not maintain a dedicated recreational department, but general recreation and golf are included in the County budget. The City has four parks with a variety of developed facilities, one 18-hole golf course, a swimming pool, and a softball complex. (U.S. Department of Agriculture, 1996). The Spring Creek Association maintains recreation facilities for Spring Creek, including an 18-hole golf course, the Horse Palace (an indoor/outdoor equestrian facility), a private lake, and other facilities (Northeast Nevada Development Authority, 1998).

Libraries

The Elko County Library provides services throughout the County. The main library is located in Elko. There are seven branch libraries (including one branch in Carlin) and two bookmobiles (U.S. Department of Agriculture, 1996). The Eureka County Library is located in Eureka. The Elko-Lander-Eureka County Library system can be accessed on line at www.lib.nv.us/docs/NSLA/CLAN/elko.html.

Public Finance

Primary governing bodies in Elko County include the Elko County Commissioners, the Elko County Planning Commission, the Elko County School District, the City of Elko, and the Tribal Council of the Elko Band Colony-Te-Moak Tribe of the Western Shoshone Indians. Three elected Elko County Commissioners administer funds for community services and maintenance of the infrastructure. The Elko County School District, also governed by an elected board, administers the largest portion (approximately 38 percent) of the Elko County budget. Eureka County, like Elko County, is governed by an elected board of county commissioners. The cities of Elko and Carlin are each governed by a mayor and council which administer funds for community services (e.g., streets, water, law enforcement, fire protection, parks, and recreation).

Nearly half of Nevada's general fund revenues are derived from a 6 percent state tax on winnings from gaming. Other state taxes include a sales tax, gas tax, cigarette and liquor taxes, drug manufacturers tax, estate and lodging tax, and net proceeds of minerals tax. Nevada has a 6.5 percent sales tax of which 2 percent is retained by the state, 2.25 percent goes to local governments and school

districts, and 2.25 percent goes to cities and counties.

The minerals industry is the only industry in Nevada that pays taxes to state and local governments on the basis of net proceeds. Mineral producers are allowed to deduct direct costs of production, such as mining and milling, and are taxed on the remaining amount (Nevada Department of Minerals, 1991). All Nevada businesses pay sales and use taxes based on the purchase of goods.

In 1994, the Bureau of Economic Analysis of the Department of Commerce ranked the per capita income for the 18 counties in Nevada. Elko County ranked 8th highest in Nevada with $21,785 per capita and Eureka County ranked 4th highest in Nevada with an average per capita of $26,984.

Table 3-37 provides a breakdown of the total revenues and expenditure for year ending June 30, 1996 for Eureka County, Elko County, and the City of Elko. The assessed valuation of property and net proceeds of mines for fiscal years 1995/96, 1996/97, and 1997/98 is provided in **Table 3-38**. Total assessed valuation of property collected by the state for Eureka and Elko counties in fiscal year (FY) 1997/98 was about $742 million and $830 million, respectively. In Eureka County, $300 million of this amount was attributable to net proceeds of minerals tax, while in Elko County, $75 million was attributable to net proceeds of minerals tax (Ambrose, 1997).

Mining operations in both Elko and Eureka counties contribute both directly and indirectly to the Elko County revenue base. The mining industry pays property taxes which account for countywide property tax revenues. The mining industry also contributes to county revenues through a net proceeds tax. Approximately 40 percent of the net proceeds tax assessed in Elko County is retained in the county, with the remaining 60 percent going to the State of Nevada general fund (U.S. Department of Agriculture, 1996).

Over the last decade, annual tax revenues from gaming collected by the state in Elko County have increased from $37.6 million to $106.1 million. The gold mining boom in Elko County is generally responsible for increased gaming activity (Nevada Department of Administration, 1990).

The biggest share of revenues for Elko County, approximately 47 percent, comes from intergovernmental transfers from federal, state, and local sources. Payments from the federal government paid as compensation for lost property tax revenue from public lands are made under the Payment in Lieu of Taxes program. Property and other taxes, including net proceeds of minerals tax, provide about 17 percent of Elko County revenues followed by charges for services (14 percent), fines and forfeitures (9 percent), licenses, fees, and permits (6 percent), and miscellaneous (8 percent). Of $2,258,724 received by Elko County in property tax revenues, $32,689 originated from net proceeds of minerals, and of the $765,129 from county licenses, permits, and fees, $343,249 was from gaming licenses and fees (Nevada Dept. Of Taxation, 1997b). Many intergovernmental transfers are associated with specific programs such as education or highways.

Approximately 31 percent of Eureka County revenues are derived from property taxes, including net proceeds of minerals tax, ($1,630,803), followed by intergovernmental transfers (58 percent) of which $76,122 was gaming tax revenues received from the state (Nevada Dept. of Taxation, 1997b). Of the $9,038 of revenues from county licenses, fees, and permits, $2,470 was from county gaming licenses and fees (Nevada Dept. of Taxation, 1997b).

TABLE 3-37
GOVERNMENTAL REVENUES AND EXPENDITURES, YEAR ENDING JUNE 30, 1996

Revenues/ Expenditures	Elko County	% of Total	City of Elko	% of Total	Eureka County	% of Total
Revenues						
Taxes	2,258,724	17%	932,626	9%	2,751,001	31%
Licenses, permits and fees	765,129	6%	966,613	9%	9,038	.1%
Intergovernmental transfers[1]	6,068,025	47%	7,359,491	71%	5,049,696	58%
Charges for services	1,759,633	14%	584,834	6%	565,745	6%
Fines and Forfeitures	1,178,805	9%	158,829	2%	97,687	1%
Miscellaneous	978,096	8%	426,943	4%	265,554	3%
Total Revenues	13,008,412	100%	10,429,336	100%	8,738,721	100%
Expenditures						
General government	3,780,487	28%	1,019,999	11%	4,887,179	52%
Judicial	3,376,661	25%	89,436	1%	522,872	6%
Public safety	5,437,924	41%	4,223,809	48%	1,476,079	16%
Public works	477,779	4%	2,275,731	26%	-	
Health and sanitation	307,120	2%	114,485	1%	490,294	5%
Welfare	-		17,000	.2%	-	
Culture and recreation	-		1,078,824		583,299	6%
Community support	47,900	.4%	50,056	1%	369,087	4%
Intergovernmental			17,776	.2%	1,063,663	11%
Total Expenditures	**13,376,220**		**8,887,116**		**9,392,473**	

Source: Nevada Department of Taxation, Local Government Finance, 1997b.
[1]Includes Payment in Lieu of Taxes (PILT) and other state and federal tax transfers or grants.

TABLE 3-38
ASSESSED VALUATION OF PROPERTY AND NET PROCEEDS OF MINES (DOLLARS)

		1995-96	1996-97	1997-98
Elko County	Assessed Valuation of Property (Ad Valorem Subject to Revenue Limitations)	656,079,055	705,262,008	755,146,300
	Assessed Valuation of Net Proceeds of Mines (Ad Valorem outside the Revenue Limitations)	15,694,164	8,358,757	75,000,000
	Total Assessed Valuation	671,773,219	713,620,765	830,146,300
City of Elko	Assessed Valuation of Property (Ad Valorem Subject to Revenue Limitations)	218,633,312	231,475,367	247,881,803
	Assessed Valuation of Net Proceeds of Mines (Ad Valorem outside the Revenue Limitations)	29,000	10,000	137,000
	Total Assessed Valuation	218,662,312	231,485,367	248,018,803
Eureka County	Assessed Valuation of Property (Ad Valorem Subject to Revenue Limitations)	457,032,308	436,473,947	442,427,183
	Assessed Valuation of Net Proceeds of Mines (Ad Valorem outside the Revenue Limitations)	565,647,057	457,493,955	300,000,000
	Total Assessed Valuation	1,022,679,365	893,907,802	742,427,183

Source: Ambrose, 1997.

Eureka County receives more revenues from property taxes than Elko County, primarily because of the extensive mining development in Eureka County. The lack of sharing of Eureka County taxes with Elko County, where most of the mining families reside, is considered a fiscal constraint by many Elko County officials and residents and an inequitable distribution of tax revenues (University of Nevada, College of Human and Community Services, 1991).

Intergovernmental transfers account for the largest share (71 percent) of revenues of the city of Elko. About 1 percent ($139,110) of intergovernmental transfers is received from Elko County gaming licenses and fees. Approximately 15 percent ($141,705) of revenues from licenses, permits, and fees is from city gaming licenses and fees (Nevada Dept. of Taxation, 1997b).

In 1996, Newmont paid ad valorem taxes totaling $21.2 million, with $20.6 million going to Eureka County and $0.6 million going to Elko County. Of the total ad valorem taxes paid by Newmont in 1996, $3.8 million was derived from net proceeds of minerals tax, $3.6 million from property taxes, and $13.8 million from sales and use taxes. The sales and use taxes were paid directly to the state, which then redistributed the taxes to the counties. Taxable property value and taxes, in Eureka County. The lack of sharing of Eureka County taxes with Elko County, where most of the mining families reside, is considered a fiscal constraint by many Elko County officials and residents and an inequitable distribution of tax revenues (University of Nevada, College of Human and Community Services, 1991). excluding sales and use taxes, paid by Newmont in 1991 and 1996 are presented in **Table 3-39**.

TABLE 3-39
NEWMONT TAXABLE PROPERTY VALUE AND TAXES PAID

(In millions)	1991	1996
Taxable Value of Newmont Property	**(est.) $658.0**	**$985.6**
Net Proceeds of Minerals Tax	$10.1	$3.8
Property Tax	$2.4	$3.6
Sales and Use Tax	$7.8	$13.8
Total Ad Valorem Taxes Paid by Newmont	**$20.3**	**$21.2**
(Portion attributable to Eureka County)	($18.4)	($20.6)
(Portion attributable to Elko County)	($1.9)	($.6)

Source: Newmont, 1997e.
Note: Data apply to the Nevada, Carlin Trend property only.

Energy Generation and Distribution

Electricity, natural gas, telephone, and mobile communication services are generally available countywide and are provided by major utility suppliers.

Electricity service to the City of Elko and Spring Creek is provided by Sierra Pacific Power Company. Carlin receives its electricity from Wells Rural Electric Company, a member-owned, nonprofit electric distribution cooperative. Telecommunications in Elko County is served by Citizens Communications telecommunication company. Natural gas in Carlin and Elko are served by Southwest Gas Corporation. Other areas of the County are supplied with propane (Sierra Pacific Power Company, 1996).

ENVIRONMENTAL JUSTICE

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires that Federal agencies identify and address, as appropriate, disproportionately high and adverse human health or environmental effects that impact low income or minority populations as a result of Federal programs, policies, or activities. For this project, the federal action being considered does not present a potential for infractions of environmental justice for the following reasons: the project has been developed at its current location due to the location of the ore body. The ore body is located in a rural, mountainous area removed from any population centers or concentrations of minority or low income individuals.

CHAPTER 4
CONSEQUENCES OF THE PROPOSED ACTION AND ALTERNATIVES

CHAPTER 4

CONSEQUENCES OF THE PROPOSED ACTION AND ALTERNATIVES

This chapter discusses anticipated direct and indirect impacts of the Proposed Action, two alternatives, and the No Action Alternative for the SOAPA. In addition, irreversible and irretrievable commitment of resources, and residual adverse effects are described. The Proposed Action is described in Chapter 2 and it basically involves developing expanded mining facilities on 1,392 acres to continue mining on the existing 7,960 acre South Operations Area Project. The impact analyses in this document will address only the incremental effects that could occur and not the total effect from both the existing and approved operations and proposed SOAPA. Cumulative impact are addressed in Chapter 5. A comparison of impacts between the Proposed Action and alternatives is summarized at the end of this chapter.

The two alternatives considered are (1) the Proposed Action with backfilling of the Mac pit, and (2) the Proposed Action with modified waste rock disposal facilities.

Potential mitigation and monitoring measures developed in response to anticipated impacts are discussed for each resource. All actions listed as mitigation measures have been developed by BLM and are not part of Newmont's Proposed Action. These measures could be required by BLM or other regulatory agencies as a condition or stipulation of approval and authorization of the SOAPA.

Irreversible and irretrievable commitment of resources and residual effects that would likely occur as a result of the Proposed Action or alternatives are discussed for each resource. Continued operation, closure, and reclamation of the SOAPA would result in an irreversible or irretrievable commitment of various resources. These resources would either be consumed, committed, or lost during and after the life of the project. Nonrenewable resources, such as minerals in the ore, would be irreversibly committed during ore-processing operations. Irretrievable commitments are those that are lost for a period of time. Residual effects would be those impacts remaining after implementation of mitigation. Cumulative effects (discussed in Chapter 5) result from incremental effects of the action when added to other past, present, and reasonably foreseeable future actions.

GEOLOGY AND MINERALS

Direct impacts of the Proposed Action and alternatives (except the No Action Alternative) on geologic and mineral resources would be limited to excavation and relocation of waste rock and processed ore and the removal of gold. Backfilling of the Mac pit would reduce the likelihood of future recovery of known gold reserves. These direct impacts would not be mitigated.

Indirect impacts would involve potential discharge of acidic water from waste rock disposal facilities and refractory ore stockpiles. Ongoing and proposed waste

encapsulation and monitoring programs would be expected to adequately prevent these potential indirect impacts. Potential instability of waste rock disposal facilities, tailing storage facilities, and pit slopes would be prevented through proper design and construction.

Predicting sinkhole development from mining activities requires consideration of site-specific geology, hydrology, topographic information, and climate. Sinkhole development is most likely in areas where carbonate rocks are at or sufficiently near the ground surface. These conditions would allow for the collapse of subsurface cavities, or piping (washing out of granular material) of the overlying soils into those cavities. Either of these processes would result in enough displacement of the cover materials to impact the surface topography. If the cavities occur within deep carbonate deposits overlain by thick consolidated material, a collapse would be unlikely to impact the surface topography (BLM, 2000b).

A large area that could potentially be susceptible to sinkhole development was identified north of the South Operations area. This area contains few buildings, major roads, or other infrastructure. Critical mine-related facilities such as waste rock storage facilities, heap leach pads, and mill and tailings facilities are not located within this area. A segment of a power line associated with the Gold Quarry Mine occurs within the area. Other non-mine-related features of note located within the area includes a 2.5-mile segment of Maggie Creek and a 2.5-mile segment of Highway 766. **Figure 4-0** illustrates this area of potential sinkhole development in relation to the predicted 10-foot drawdown contour.

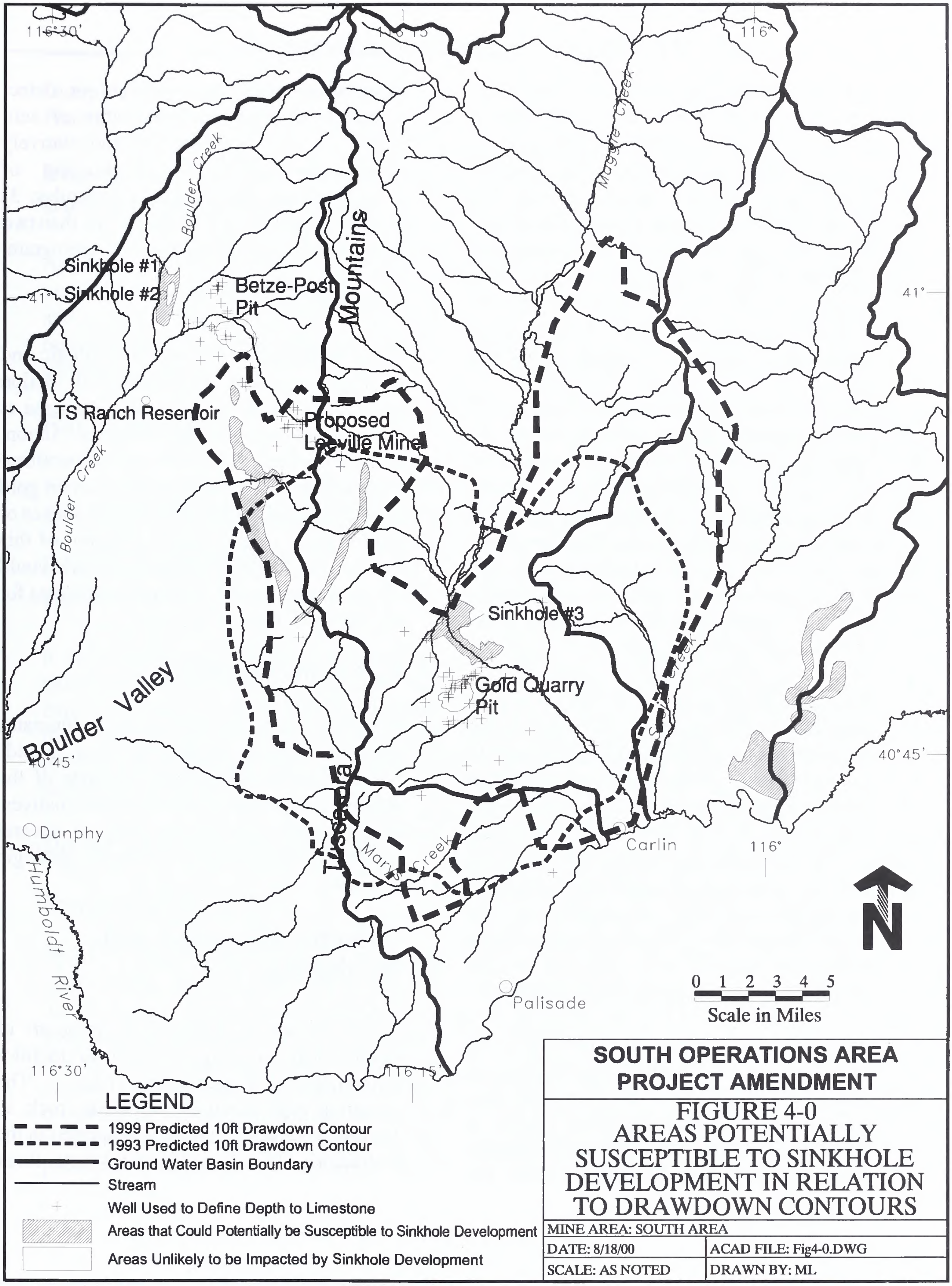
It is important to note that information on the depth to carbonate rock and thickness of cover materials is based on limited subsurface information. The site specific risk of sinkhole development will depend, in part, on site conditions including depth to carbonate rocks, mineralogical and hydrological characteristics of the carbonate rock, size of new or pre-existing voids in the carbonate rock, properties of the overlying materials, and hydrologic changes induced by the cumulative mine dewatering and water management activities (BLM, 2000b).

Direct and Indirect Impacts

Proposed Action

Direct impacts of the Proposed Action on geologic and mineral resources would include relocation of approximately 408 million tons of waste rock and 118 million tons of processed ore to various waste rock disposal facilities, tailing storage facilities, and leach pads. In addition, several million ounces of gold would be extracted from the geologic resource.

Indirect impacts of the Proposed Action could arise from placement of potentially acid-producing material in waste rock disposal areas and refractory ore stockpiles. Rain and snowmelt infiltrating through waste rock and ore piles could potentially cause an acidic discharge through contact with these materials.



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-0
AREAS POTENTIALLY SUSCEPTIBLE TO SINKHOLE DEVELOPMENT IN RELATION TO DRAWDOWN CONTOURS

MINE AREA: SOUTH AREA	
DATE: 8/18/00	ACAD FILE: Fig4-0.DWG
SCALE: AS NOTED	DRAWN BY: ML

The SOAPA would produce potentially acid-generating waste rock. The Gold Quarry North and South WRDFs are designed to accommodate potential acid generating rock. Potential impacts from acid rock drainage are expected to be low because of construction techniques, the capture of any drainage, monitoring, depth to groundwater (see Chapter 2, South Operations Area Waste Rock Disposal Facilities, and Resource Monitoring), and low precipitation in the area.

The issue of acid production was evaluated in the original EIS (BLM, 1993). The SOAPA calls for an increase in mining of refractory ore. Therefore, the relative proportion of acid-generating rock resulting from the Proposed Action may be higher. However, Newmont proposes to use the same procedures for handling potentially acid-producing waste rock and refractory ore stockpiles as those analyzed by the BLM (1993).

Encapsulation of acid-producing waste rock within the middle of waste-rock piles under the provisions of the Refractory Ore Stockpile and Waste Rock Dump Design, Construction and Monitoring Plan is expected to prevent any impacts of acid production (Newmont, 1997b, Appendix B). Waste rock would be monitored for waste rock chemistry in order to properly route the materials to an encapsulation site. Additional information about encapsulation was provided in the section on Existing Operations in Chapter 2.

Refractory ore stockpiles may be a source of acid drainage over the life of the operation. These stockpiles are not expected to exist after project closure and, therefore, have a relatively short-term potential for producing acid drainage. The following factors are expected to adequately mitigate or detect potential formation and discharge of acid water: 1) acid-neutralizing soils and relatively deep water table; 2) construction of compacted clay pads beneath stockpiles; 3) temporary closure of stockpiles older than two years; and 4) Newmont's monitoring program.

Alternatives

Direct and indirect impacts on geologic and mineral resources for the two action alternatives would be essentially the same as those resulting from the Proposed Action, with the exception of burying mineralized gold resources in the Mac pit. Known gold resources of up to 70,000 to 80,000 ounces of gold may be lost by implementation of this alternative. The backfilling alternative would also eliminate the pit walls as a study area for geology and paleontology.

No Action Alternative

The No Action Alternative eliminates proposed future expansion and avoids potential direct and indirect impacts of the Proposed Action and other action alternatives. It also eliminates the recovery of several million ounces of gold from the geologic resource.

Potential Mitigation and Monitoring

Newmont would continue its program of waste rock sampling in order to monitor potentially acid generating rock. The sampling and handling of waste rock to prevent acid rock drainage is described in the Refractory Ore Stockpile and Waste Rock

Dump Design, Construction and Management Plan (Newmont, 1997b, Appendix B).

Irreversible and Irretrievable Commitment of Resources

Approximately 526 million tons of material would be removed from the Gold Quarry pit and stored on the surface. Several million ounces of gold would be removed from the geologic resource.

Residual Effects

No unmitigated residual effects to the geologic resource would be expected.

PALEONTOLOGICAL RESOURCES

It is possible that expansion of the Gold Quarry pit into the Carlin Formation could expose subsurface paleontological deposits, but this eventuality cannot be confidently predicted through available data or further surface inspections.

Direct and Indirect Impacts

Proposed Action

Impacts on fossils would be direct, caused by physical disturbance. Because fossils are usually buried, there is no way of confirming their location or distribution until excavation occurs. In terms of potential in-situ fossil materials, most of the actions would involve disturbance of unconsolidated soil levels that are unlikely to yield significant materials. The principal disturbance of potential fossil bearing deposits would be the deepening and expansion of the Gold Quarry pit. Although the potential for unique or important fossil material in the mine area appears low, mine crews and supervisory personnel would be made aware of the potential for encountering fossils, and should notify the BLM authorized officer if any vertebrate fossils are encountered.

Alternatives

Impacts on paleontological resources resulting from either of the two alternatives would be the same as those discussed under the Proposed Action. Impacts would be limited to areas of development. Backfilling the Mac pit in Alternative 1 would eliminate the pit walls as a study area. Pit walls can be regarded as study areas but the safety issue of access would have to be addressed.

No Action Alternative

The No Action Alternative would eliminate potential impacts on paleontological resources in areas of proposed development. Closure and abandonment of the South Operations Area would involve soil replacement, regrading, recontouring, and other reclamation activities that may cover or uncover previously unknown fossils, depending on the location and type of disturbance.

Potential Mitigation and Monitoring

When fossils are discovered during mine development or operational activities, steps would be taken to identify them and preserve them, when appropriate. Newmont would

contact the BLM to determine the steps necessary for recovery of fossils.

Irreversible and Irretrievable Commitment of Resources

An irreversible and irretrievable commitment of paleontological resources would occur as a result of the Proposed Action if fossils are encountered. However, additional information about the resource would be obtained and an assessment of the significance would be made.

Residual Effects

No residual effects on paleontological resources are anticipated as a result of the Proposed Action or alternatives.

AIR RESOURCES

Air quality in the project area would be slightly affected by the SOAPA. The only effect of the amendment would be a slight, short-term increase in particulates and diesel exhaust emitted during construction activities and from wind-blown fugitive dust from a 17.5 percent increase in disturbed areas, assuming no concurrent reclamation. However, the small increase in particulate emissions would not cause violations of National or State of Nevada Ambient Air Quality Standards.

Direct and Indirect Impacts

Proposed Action

Under the Proposed Action, no expansion of Mill 5, the oxide ore treatment plant, or Mill 6, the refractory ore treatment plant, would occur. Therefore, the modeled ambient air concentrations described in Chapter 3 would not increase. All criteria pollutant emissions (PM_{10}, NO_x, SO_2, CO) from these facilities are currently less than 10 percent of the levels allowed by the National and State of Nevada Ambient Air Quality Standards.

PM_{10} in the form of fugitive dust emissions are directly related to the amount of material processed and the amount of disturbed land exposed to wind-blown erosion. The process rate would not increase under the Proposed Action. However, the amount of disturbed land would increase by 17.5 percent (7,960 acres presently to 9,352 acres with the amendment). Therefore, fugitive dust emissions could cause a maximum increase of ambient air concentrations by 17.5 percent to 105 $\mu g/m^3$ for a 24-hour period and 27 $\mu g/m^3$ for the annual average. This value would be 70 percent of the 24-hour and 54 percent of the average annual allowable Federal and State of Nevada Ambient Air Quality Standards (150 $\mu g/m^3$ and 50 $\mu g/m^3$, respectively). The amendment would not cause any exceedance of ambient air quality standards.

The monitoring of PM_{10} showed elevated particulates during 1994 when construction was taking place. PM_{10} levels would be temporarily elevated during the enlargement of the Gold Quarry pit, construction of haul roads; enlargement of the Gold Quarry North, Gold Quarry South, and James Creek WRDFs; and construction and enlargement of the Property Leach Pad 2, Non-Property Leach Pad, and Refractory Leach Pad.

Alternatives

Air quality impacts under either alternative would be similar to the Proposed Action. Haul road configurations would be changed under Alternative 1 and fugitive particulates would be generated in locations north and west of the Gold Quarry pit. Haul miles would likely be greater, resulting from a longer haul upgrade to the Mac pit. Haul trucks exiting the pit at the southwest corner would travel more than 8,200 feet to reach the Mac pit versus 3,000 feet to reach the South or James Creek WRDFs. Haul trucks exiting the pit on the east side might have to travel 12,000 feet to reach the Mac pit versus less than 6,000 feet to reach the North WRDF. Therefore, diesel combustion emissions would also be greater than under the Proposed Action.

No Action Alternative

Under the No Action Alternative, mining operations would cease around 2001. The air quality would return to pre-mining levels after reclamation of disturbed areas is complete.

Potential Mitigation and Monitoring

No mitigation measures are proposed, as Newmont's application of Best Management Practices (Handbook of Best Management Practices, Nevada State Conservation Commission, 1994) are sufficient to meet state and federal standards.

Irreversible and Irretrievable Commitment of Resources

No irreversible or irretrievable commitment of air resources would result from the Proposed Action or alternatives.

Residual Effects

No residual effects to the air quality would be anticipated as a result of the Proposed Action or alternatives. Following mine closure and reclamation, air quality would be expected to return to pre-mining conditions.

WATER RESOURCES

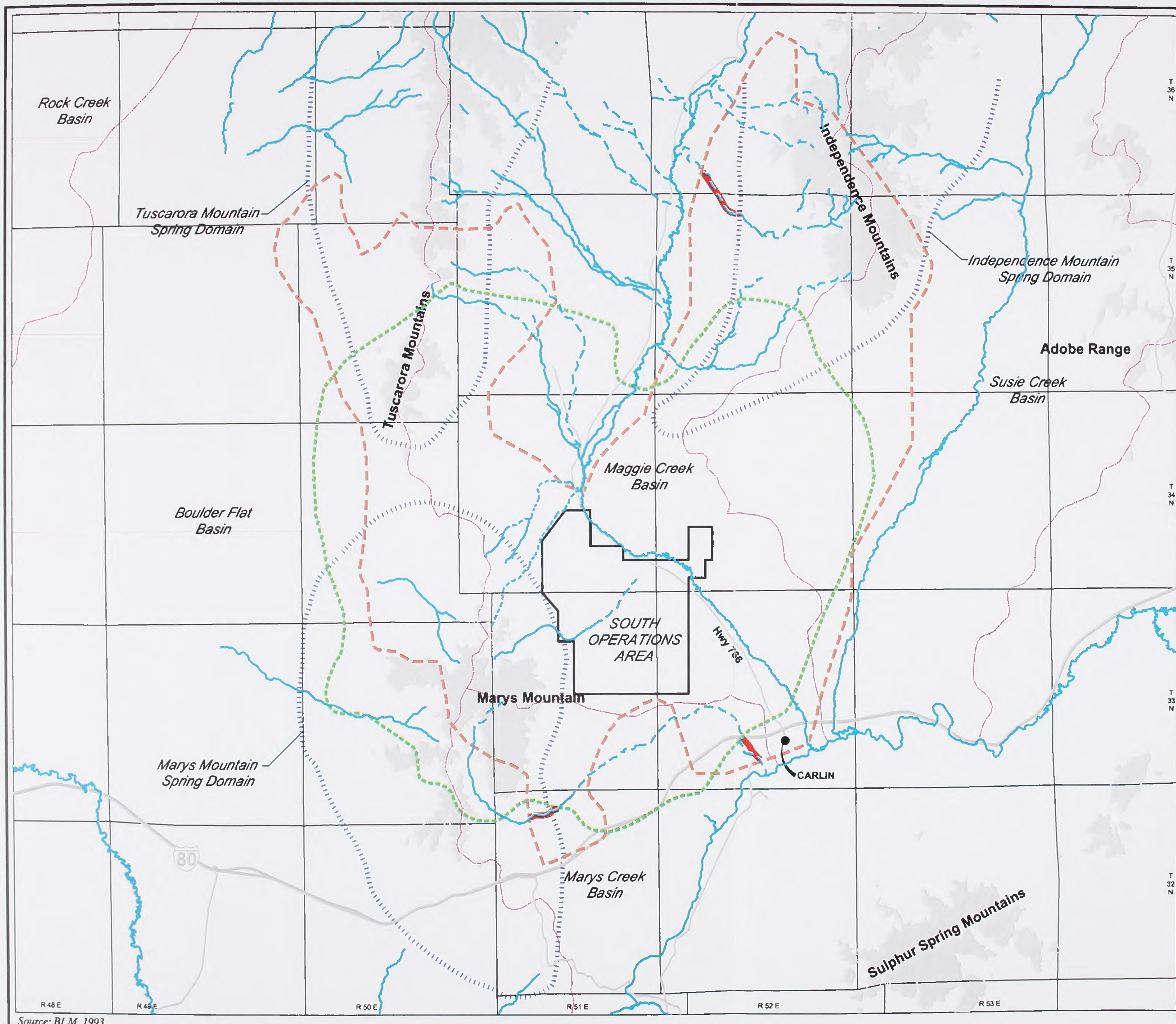
The SOAPA would require continued dewatering as the mine pit deepens and ultimately extends approximately 1,805 feet deep below the pre-mining surface, 350 feet deeper than previously analyzed. Declining groundwater levels surrounding the mine pit would create a cone of depression that would affect flows of some springs, seeps, and streams in the study area. When dewatering ceases at the end of year 2011, the Gold Quarry pit would begin to fill with groundwater; water depth would approach 95 percent of the observed pre-mining water table

elevation after 60 years (HCI, 1999). Flows from impacted springs, seeps, and streams would begin to recover from about year 2015, depending on location.

Most springs in the mountains are supplied by perched aquifers (not hydrologically connected to deeper aquifers) and therefore are not likely to be affected by mine dewatering. Based on the extent of groundwater drawdown predicted by a numerical groundwater model (HCI, 1999) up to 5 spring and seep sites could be impacted through reduced or lost flows in the vicinity of the Gold Quarry pit beyond the 25 sites analyzed in 1993. Some of these sites include more than one spring or seep located in a group. The Carlin "Cold" Spring system used by the town of Carlin as a water supply source is predicted to have a significant reduction in baseflow. Some water wells also may be impacted by the cone of depression; however, only two existing private wells are predicted to be completely dewatered. Groundwater level drawdown would extend asymptotically and result in an irregular pattern, in plan view, approximately three to 15 miles around the mine pit. Maximum impacts on springs, seeps, and groundwater levels would occur roughly between years 2000 to 2050 (HCI, 1999). After nearly 150 years, groundwater is anticipated to recover to within approximately 8 feet of pre-mining levels.

Excess water from the dewatering system would continue to be discharged to Maggie Creek under the Proposed Action. Changes in Maggie Creek water temperature are minimized through the use of a cooling tower for discharge water; hence, Maggie Creek water temperature would not affect Humboldt River water temperature. Stream erosion has been minimized through the use of bank stabilization measures. During the dewatering period, maximum discharge in lower Maggie Creek could be as high as 65 cfs (29,000 gpm). This is a decrease from flows of 104 cfs (46,400 gpm) analyzed in the original EIS (BLM, 1993). No impacts on surface water quality are allowed by Newmont's current discharge permit. Currently discharged untreated water does not exceed National Pollutant Discharge Elimination System (NPDES) water quality standards. An existing, but currently unused water treatment facility would be employed, if necessary, to meet the standards. The treatment facility was designed to treat 20,000 gpm, and treatment for arsenic was a major design feature.

The cone of depression is predicted to reduce baseflows in some streams in the project area during and/or after the dewatering period. Affected streams would include middle and lower Maggie and Susie creeks, and lower Marys Creek (primarily the Carlin "Cold" Spring). Some reaches of Maggie Creek tributaries north of the mine, also could experience loss of or reduction in baseflow. **Figure 4-1** shows the stream reaches within the 10-foot drawdown contour. Baseflow in the Humboldt River between Carlin and Palisade could be reduced by as much as 5 cfs after dewatering ceases. (The 1993 analysis indicated a reduction of 19 cfs.) Lowest average monthly baseflows prior to mining were in September and October with rates of 26 and 46 cfs, respectively. These reductions in surface water baseflow would be most significant during the first 10 to 20 years after cessation of mining. It is predicted to take up



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-1
PREDICTED IMPACTED STREAM REACHES

MINE AREA: SOUTH AREA
DATE: 8/1/00 | ACAD FILE: Fig4-1.DWG
SCALE: AS NOTED | DRAWN BY: EC, MODIFIED BY EG

to several decades for baseflow in some streams to completely recover to pre-mining conditions; the Humboldt River may have baseflow permanently lowered by 1.5 cfs.

The Gold Quarry pit is predicted to eventually fill with groundwater to an ultimate depth of approximately 1,370 feet. The pit lake surface is predicted to be near 5,091 feet elevation above mean sea level. The groundwater level near the pit lake is predicted to recover to approximately 8 feet below the pre-mining water table after around 150 years, and to take around 60 years to reach 95 percent of this level, or 38 feet below the pre-mining water table (HCI, 1999). Most of the pit lake would form during the first 10 to 20 years after the dewatering system is discontinued. A study utilizing laboratory tests and computer models was conducted to predict the quality of water that would collect in the mine pit (Geomega, 1997b). Ultimate quality of mine pit water is predicted to be similar to or better than existing groundwater in the ore zone because of: (1) carbonate rock in the pit that prevents development of acidic conditions; (2) removal of the mineralized zone and associated sulfides and groundwater during mining; and (3) adsorption and deposition of trace metals on ferric hydroxides.

Direct and Indirect Impacts

Direct and indirect impacts on groundwater and surface water resources would result from the SOAPA. These impacts would be associated primarily with the dewatering activities necessary to allow continued mining below the water table.

Few additional direct and indirect impacts associated with the Proposed Action beyond the impacts approved by the BLM (1993) are expected. Some impacts could occur as a result of new or expanded mine facilities. Disturbed areas such as waste rock disposal facilities, ore stockpiles, leach pads, mine pit, pipeline corridors, roads, and ancillary facilities would have increased erosion Waste rock and ore stockpiles also would have potential for generating acidic drainage.

In 1993, the BLM analyzed potential dewatering effects based on computer modeling that predicted a 10-foot drawdown contour line that encompassed an area of 152,000 acres. The computer modeling conducted for the SOAPA predicted a 10-foot drawdown contour line that is 17 percent larger than the 1993 contour. The incremental area for potential drawdown is approximately 26,000 acres. Significantly, the predicted drawdown contour encompasses very small increments of stream reaches, springs, riparian habitat, and grazing areas, compared to those analyzed in 1993. Additionally, the predicted drawdown contour line in 1999 has some major contour changes that have the effect of reducing the miles of streams and acres of riparian areas that are predicted to be affected by water drawdown in the incrementally expanded study area. As a result, this EIS will analyze only the incremental effects. Cumulative effects are analyzed separately in Chapter 5.

Proposed Action

Dewatering System

Groundwater is currently pumped from wells at the South Operations Area for purposes of keeping the mine dry, milling, processing, environmental controls, and other related activities. Dewatering of the mine pit would be extended until the end of year 2011, to allow continued mining laterally and at depth.

The rate of groundwater pumping would continue at flow rates lower than those analyzed in the original EIS (BLM, 1993). After 2011, groundwater withdrawal would be significantly reduced to meet continued ore processing and reclamation demands for approximately five additional years. Predicted groundwater withdrawal rates until the end of year 2011 are presented in **Figure 4-2**.

A hydrogeologic numerical model was developed to predict necessary dewatering rates at the Gold Quarry Mine (HCI, 1992, 1996, 1999). A dewatering rate of up to 42,000 gpm was analyzed in 1993 (BLM, 1993). Dewatering pumping rates of up to 25,000 gpm are expected during the life of the proposed project (HCI, 1999) (**Figure 4-2**). Currently, the average annual pumping rates are less than 20,000 gpm (Newmont, 1999c). Following the completion of the Gold Quarry mining operations, pumping rates would continue for approximately five years at a rate of 2,500 gpm to support process operations.

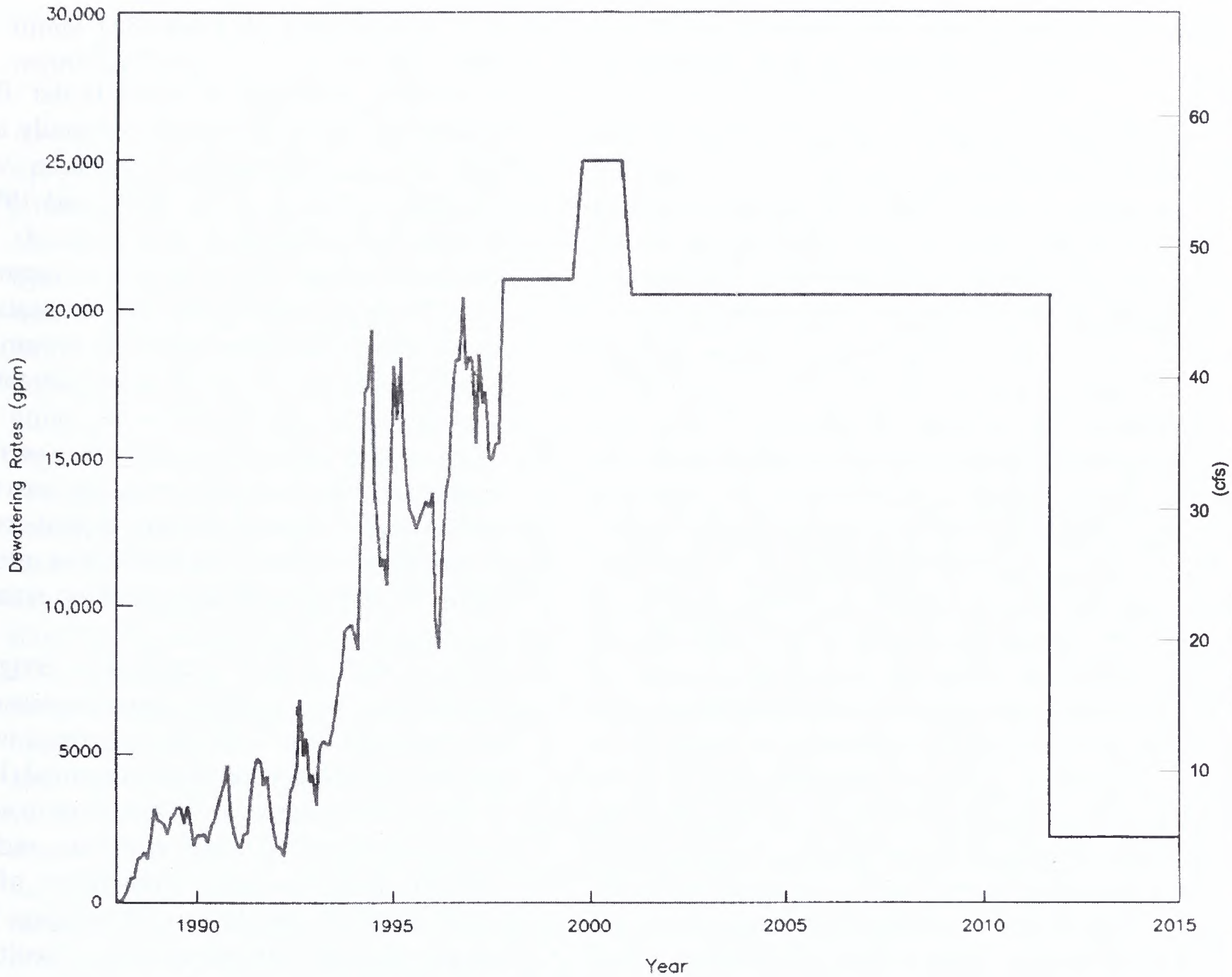
Excess water from the dewatering system is currently used in mine operations, ore processing, road watering, work area watering, irrigation and is also discharged in Maggie Creek below Maggie Creek Canyon and would continue to be discharged for the additional mining period. During periods of high natural flow in Maggie Creek, excess mine water would continue to be stored temporarily in the Maggie Creek Ranch Reservoir.

Water Treatment System

A water treatment system was installed. However, the treatment plant was used for only one month, because arsenic (metal of primary concern) levels of the untreated water never exceeded the NPDES water quality standards (Pettit, 1998). Water quality would continue to be analyzed regularly. It is not expected that the NPDES water quality standards would be exceeded. However, should this occur, the water treatment plant would be put into operation.

Water Storage Reservoir

The existing Maggie Creek Ranch Reservoir and its operation were discussed in the original EIS (BLM, 1993) and is not a part of the SOAPA proposal. However, its operation is still affected by the SOAPA. The existing Maggie Creek Ranch Reservoir has a capacity of 6,000 acre-feet compared to its capacity in 1993 of 2,700 acre-feet. The reservoir allows Newmont to withhold discharge to Maggie Creek during high-flow periods. Under its current operation the reservoir has never been completely filled. Any flood waters that exceed the capacity of the reservoir would be discharged to the unnamed tributary of Maggie Creek through the spillway. Water storage in Maggie Creek Ranch Reservoir would continue during the extended period of



Total Produced 1988-1998 161,000 acre-feet.
Total Predicted 1999-2011 400,000 acre-feet.

SOUTH OPERATIONS AREA PROJECT ADMENDMENT

FIGURE 4-2
PAST (ACTUAL) AND PREDICTED DEWATERING RATES FOR THE GOLD QUARRY MINE

DATE: 6/6/00	ACAD FILE: Fig4-2.DWG
SCALE: NTS	DRAWN BY: EC, MODIFIED BY DS

Source: HCI, 1999.

the mining operations. The reservoir would be used for ranch purposes post-mining.

Stored water in the reservoir is released to Maggie Creek by pipeline during the remainder of the year in order to make storage available for the following spring runoff period. During 1997, discharge was routed to Maggie Creek Ranch Reservoir twice in the first quarter during high flows in Maggie Creek. Approximately 1,350 acre-feet were in temporary storage at the end of the first quarter. This water was released during the second quarter. Approximately 525 acre-feet remained in temporary storage at the end of the second quarter. Water management would be similar under the Proposed Action. A maximum rate of about 10 cfs (4,500 gpm) of water is released from the reservoir if discharge from the full reservoir is distributed evenly during a 10-month period each year. A discharge structure containing a concrete stilling basin, and channel constructed with riprap, transfers water to the Maggie Creek channel. Releases are also made from the reservoir to meet irrigation demand on land adjacent to Maggie Creek during the growing season. Between 1,800 and 4,900 acre feet per year (1,100 to 3,000 gpm per day over 90 days) were used for this irrigation diversion annually in the period from 1994 to 1998, and similar annual amounts are expected to be used for irrigation in the future.

Seepage from the Maggie Creek Ranch Reservoir recharges groundwater in the underlying alluvium and Carlin Formation, causing some additional groundwater baseflow in lower Maggie Creek Basin.

Groundwater Flow Model

Numerical modeling of groundwater flow systems in the South Operations study area has been conducted in conjunction with Newmont by HCI (1992, 1996, and 1999). The model produces a prediction of the amount of groundwater that must be removed from the mine pit area, providing the basis for designing an effective dewatering system. In addition, the model predicts the extent of groundwater drawdown, or cone of depression, that would result from dewatering. Impacts on baseflows in the modeled area also are predicted. Finally, the model predicts the rate at which groundwater would flow into the mine pit after dewatering operations cease.

The model uses the computer program MINEDW to predict three-dimensional groundwater flow with an unconfined water surface using the finite-element method (HCI, 1992). This program was developed to solve problems related to mine dewatering and has special attributes (e.g., simulation of an excavation and calculation of the seepage face on the pit wall) for that purpose. Geologic, hydrologic, and climatological data were incorporated into the conceptual hydrogeologic model describing groundwater and surface water flow in the study area. BLM has reviewed and approved the application of the model to the Gold Quarry Mine (Sandia National Laboratories, 1998). The model was calibrated to known conditions, such as recharge values, water level elevations, stream baseflows, and hydraulic testing results (drawdown and recovery tests). The BLM subjected the model calibration to an intensive review in late 1998 and early 1999. Model calibration is an ongoing activity and will continue in the

future to refine predictive capabilities and improve efficiency of dewatering operations.

As with all groundwater models, MINEDW is a predictive tool, the effectiveness of which is a function of the hydrogeologic data utilized. Newmont has developed a comprehensive hydrologic database in the mine pit area as well as the surrounding region to support the model. Supplemental USGS regional information was incorporated into the numerical model in areas, such as boundary regions, that lack detailed hydrogeologic data. Predictions of groundwater drawdown and baseflow impacts must be considered with the understanding that actual conditions may deviate from the predictions. For purposes of this EIS, the predicted maximum extent of the 10-foot drawdown contour line was selected to represent the general area of hydrogeologic impact. It was selected because it approximately represents the limit of seasonal variation in the water table. The 10-foot drawdown contour was created by selecting the maximum extent of drawdown in any modeled year; thus, the drawdown contour does not represent the actual drawdown in one specific year, but the maximum extent of the 10-foot drawdown during and after mining. Specific results of the model are discussed below.

Impacts on Groundwater Levels

Dewatering operations at the Gold Quarry Mine would result in development of a cone of depression in the water table surrounding the mine pit. Extent of drawdown for the water table using the maximum 10-foot drawdown contour is shown in **Figure 4-3**. For comparison, the 10-foot drawdown contour as previously analyzed by the BLM (1993) is also shown.

The groundwater drawdown would be greatest close to the mine pit. Drawdown would also occur outside of the 10-foot contour line shown in **Figure 4-3**; however, water level changes in these areas would be difficult to distinguish from seasonal or long-term variations in natural conditions.

Groundwater drawdown would continue beyond the active dewatering of the mine. This water would come from storage and continued decrease in natural groundwater discharge. Drawdowns from mining activities through December 1998 are up to 600 feet in the siltstone and carbonate bedrock. The current model (1999) 10 foot drawdown contour extends in an ellipse approximately 9 miles to the northwest and the southeast of the mine pit (**Figure 4-3**). In the northwest, the 10-foot contour line overlaps with the drawdown contour line from the Post/Betze pit dewatering operations. The monitored 10 foot drawdown contour line (**Figure 4-3**) extends beyond the 10 foot modeled (HCI, 1999) drawdown contour at Susie Creek in the southeast and at Maggie Creek, north of the mine. Several things cause the apparent discrepancy between the monitoring and modeled drawdown contours. First, the monitoring drawdown reflects actual cumulative impacts from Barrick and Newmont dewatering activities, whereas the modeled drawdown is for Newmont's dewatering only. In addition, the monitoring data reflects measurements from only a few wells and the drawdown contours in the

suspect area are inferred. It should also be noted that modeling results are theoretical approximations and need to be verified with monitoring data.

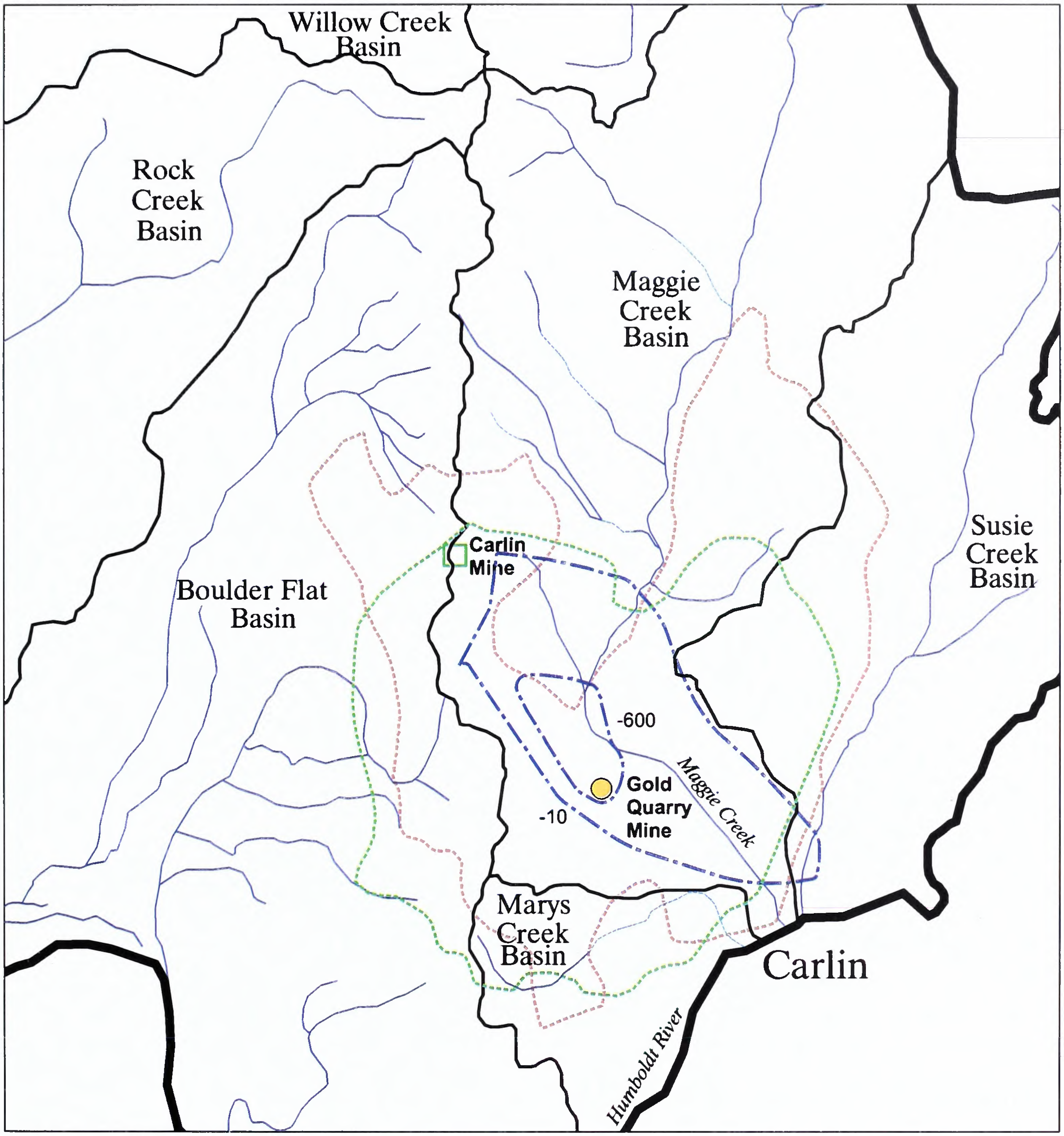
Total volume of groundwater removed by the South Operations Area dewatering system through December 1998 was 161,000 acre-feet (Newmont, 1999c). Additional volume removed through 2011 would be approximately 400,000 acre-feet (HCI, 1999). In 1993, the volume through 2001 was estimated at 500,000 acre-feet (BLM, 1993).

After year 2011, the cone of depression would diminish as the pit fills with water and groundwater levels rise toward pre-mining conditions. Initial rate of water recovery in the mine pit would be relatively rapid, followed by a decreasing rate of pit infilling as hydraulic gradients into the pit decline. The pit lake would recover to approximately 95 percent or within 38 feet of the pre-mining water table approximately 60 years after dewatering ceases (HCI, 1999). The numerical model predicts that water in the mine pit would ultimately recover to less than 8 feet below pre-mining levels within 150 years of completing dewatering operations, or around 2162 (HCI, 1999). A graph of the projected lake filling is presented later in this chapter in **Figure 4-15.** Complete recovery to pre-mining levels of the water table in the study area is not expected due to evaporation from the pit lake. Equilibrium may take approximately 150 years to reach as natural recharge and discharge of groundwater in the basin come to a new balance with the pit lake evaporation.

No drawdown is apparent in the Carlin Formation. However, water levels have been rising to the south of Maggie Creek Ranch Reservoir, likely due to seepage from the reservoir, reduced pumping from the Carlin Formation near Gold Quarry, increased recharge along Maggie Creek as a result of mine dewatering discharge, and not pumping the Hadley Field irrigation wells (**Figure 4-4**).

Some localized increases in groundwater levels may continue to occur in the Carlin Formation underlying the Maggie Creek Ranch Reservoir and lower Maggie Creek. Groundwater level increases below the reservoir result from seepage out of the reservoir. When lower Maggie Creek has additional flow during the dewatering period, groundwater levels in this area increase also. Current monitoring in Maggie Creek Basin shows that water levels increased by up to 45 feet from 1992 to December 1998 directly south of Maggie Creek Reservoir in the Carlin Formation (Newmont, 1999c).

Monitoring well data indicate that water levels in the Carlin Formation directly south of the reservoir may not rise further, however water levels farther from the reservoir may continue to rise while water is being stored in Maggie Creek Reservoir. Water infiltration from the additional discharge in Maggie Creek would contribute to this rise. The increase of water levels in the Carlin Formation is also due to reduced pumping for irrigation, as irrigation demand is now met by Gold Quarry dewatering pumping from lower formations. The rate of increase would most likely slow down, and possibly a steady state would be reached during the life of the mine. There is not likely any significant flow from the Carlin Formation to the bedrock aquifer as a result of the groundwater mound caused by the Maggie Creek Ranch Reservoir. The base of the



Souce: HCI, 1999; BLM, 1993; Newmont, 1999c.

LEGEND

- = Original Gold Quarry Mine Using 1993 EIS Model (BLM, 1993a)
- = Gold Quarry SOAPA Using Carlin Trend Model (HCI, 1999)
- = Current (1998) Monitoring (Newmont, 1999c)
- = Basin Boundary
- = Model Boundary
- = Perennial Streams
- = Intermittent Streams

0 10 20 30 40

Scale in Miles

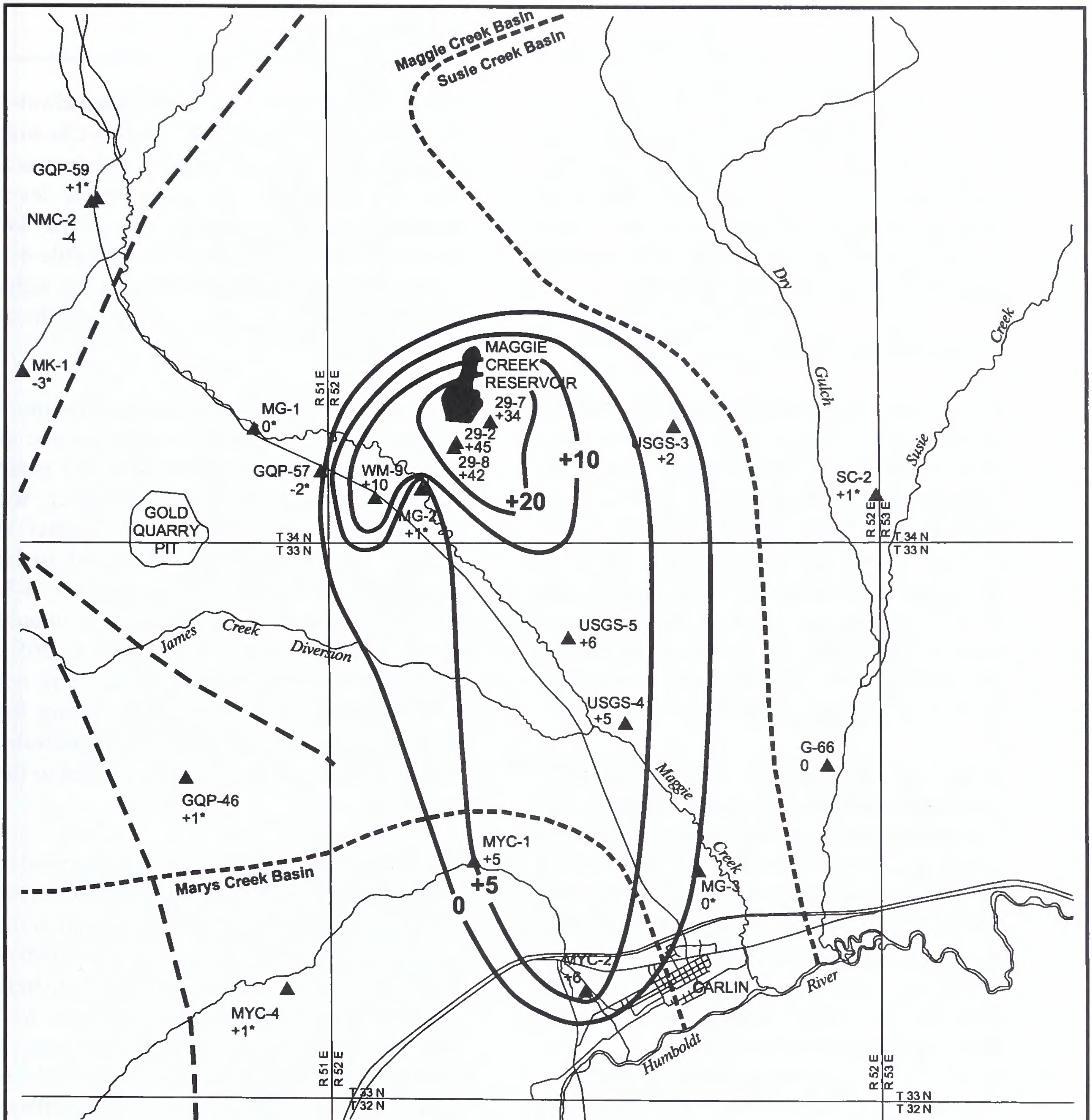
N

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-3

MAXIMUM EXTENT OF 10ft DRAWDOWN CONTOUR PREDICTED BY 1993 EIS MODEL, 1999 SOAPA MODEL, AND CURRENT MONITORING

MINE AREA: SOUTH AREA	
DATE: 8/1/00	ACAD FILE: Fig4-3.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY EG



LEGEND

- ▲ Alluvium, Colluvium, Tertiary Volcanics, Tertiary Carlin piezometer
- Approximate hydrologic basin boundary
- Inferred fault path
- —8— Carlin Formation water elevation change

Source: Newmont, 1999c.

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FIGURE 4-4
CARLIN FORMATION WATER ELEVATION CHANGE
(May 11, 1992 to December 31, 1998)

DATE: 6/6/00	ACAD FILE: Fig4-4.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY EG

Carlin Formation has a clay layer of substantial thickness and most monitor wells throughout the area show no definite connection. Water levels in the Carlin Formation in the upper Maggie Creek Basin are expected to fall in the future because of dewatering in the underlying aquifers.

Impacts on Wells

Drawdown of groundwater due to dewatering activities would have limited impacts on some wells in the vicinity of the South Operations Area beyond the impacts already stated in the original EIS (BLM, 1993). Impacts could include decreased water yield, increased pumping costs, or possibly lowering the water level below the pump depth or the screen interval. The extent of impact would depend on the magnitude of drawdown with respect to well depth and type of aquifer(s) affected.

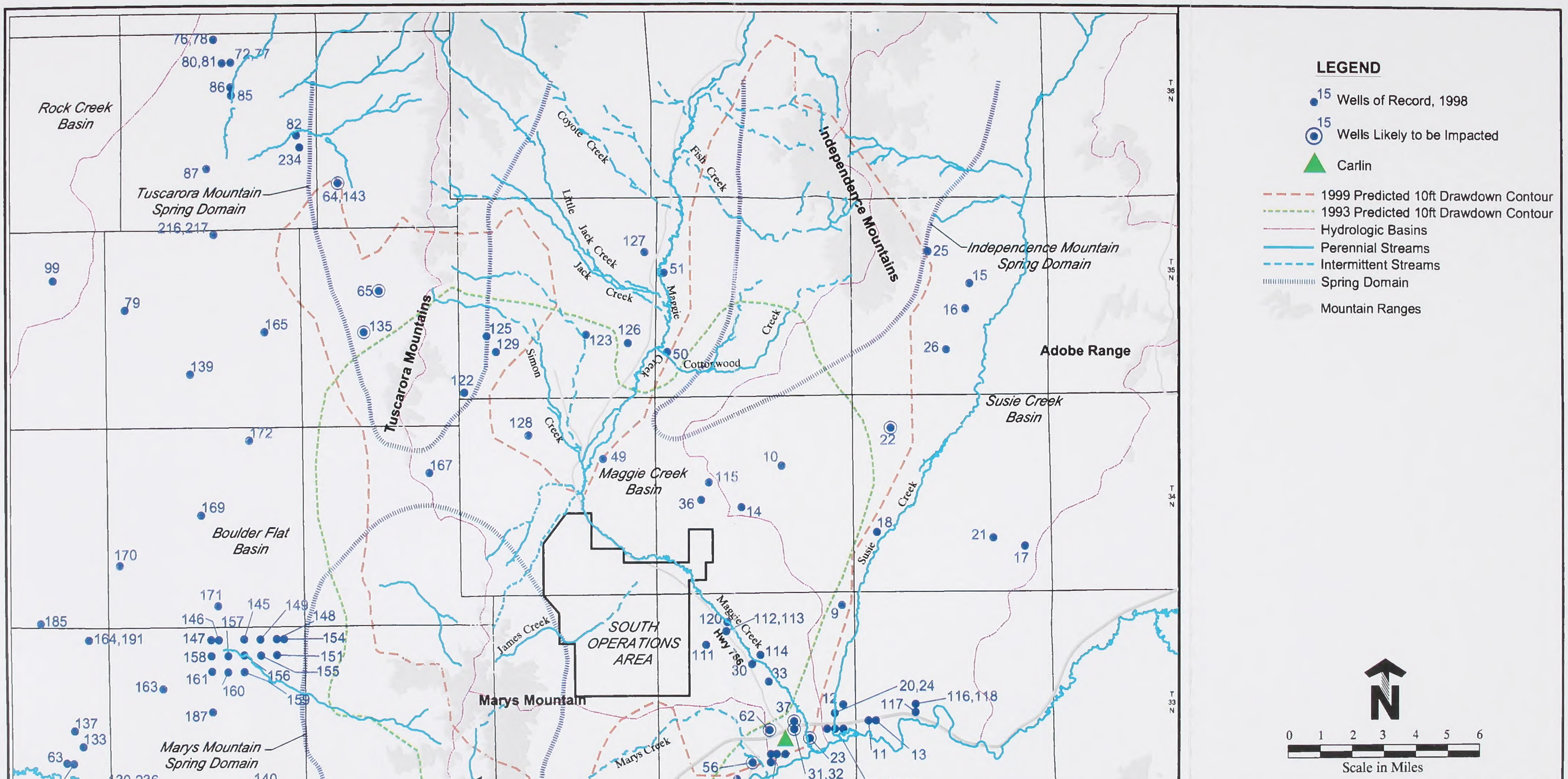
Locations of known wells, excluding Newmont's mining, milling, production, and monitoring wells, are shown in **Figure 4-5**, along with maximum extent of the 10-foot drawdown contour for the water table system. Wells outside this contour line are expected to be unaffected due to limited groundwater drawdown. Some time after dewatering ends, groundwater levels within the cone of depression would begin to rise.

There are 11 known wells located within the maximum 10-foot drawdown contour (**Figure 4-5**), (fifteen wells were analyzed in 1993.) Included are private wells and non-mining wells owned by Newmont or the Newmont-owned company "Elko Land and Livestock." These wells are currently predicted to be indirectly impacted by the Proposed Action.

Depths of well screen and static-groundwater levels are reported in **Table 4-1** for wells with available information. The difference between well screen depth and static water level generally is the available drawdown for withdrawal of water from a well. **Table 4-1** shows that available drawdown for the wells within the 10-foot drawdown area ranges from 7 to 484 feet.

Two wells have predicted drawdowns of more than 40 feet. Well screen depths for one of these wells is not available; thus the exact impact cannot be predicted. However, the drawdown is substantial, so an impact is likely. The eleven wells predicted to be impacted are highlighted on **Figure 4-5.** Maximum water level drawdowns would occur roughly between years 2000 to 2050. Wells located near Maggie Creek may not experience water level declines during the dewatering period because of groundwater recharge from dewatering flows added to the creek.

Several private and public wells are located in or near the town of Carlin (**Figure 4-5**). One of these wells (#62 on **Table 4-1**) is part of the town's public water supply. This well is 649 feet deep with a water level approximately 165 feet below ground surface. Another well (#37 in **Table 4-1**) is used by the town of Carlin for irrigating a park and is approximately 100 feet deep (Balleau Groundwater Consulting, 1992). Maximum groundwater drawdown in these two wells and other wells in the Carlin area resulting from the South Operations Area cone of depression would be less than 20 feet (a drawdown of up



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-5
PREDICTED IMPACTED WATER WELLS

MINE AREA: SOUTH AREA	
DATE: 8/1/00	ACAD FILE: Fig4-5.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY: DS

Table 4-1
Ground Water Wells
Potentially Impacted by SOAPA Dewatering

Map #	Permit Number	Status	SWL (feet)	Bottom Screen (feet)	Max. Avail. Draw-down	SOAPA EIS Estimated Drawdown (feet)	TN	RE	Sec.	QQ	QTR	Use	Diversion Rate (cfs)	Annual Duty (Acre-Feet)	Owner	Comment
Water Wells Inside 10-foot Drawdown Contour																
22	53179	CER	375	600	225	25	34N	53E	5	SW	SW	STK	0.031	22.41	Maggie Creek Ranch, Inc.	
23	54522	CER	10	170	160	<10	33N	52E	26	SW	NE	COM	0.056	0.03	The Anschutz Marketing and Trans.	
31	20227	CER	23	76	53	13	33N	52E	26	NW	NW	IRR	0.045	5.59	Meierhoff, Randy & Carmelia	
32	22214	CER	17	24	7	13	33N	52E	26	NW	NW	IRR	0.011	7.20	Meierhoff, Ralph J.	Entirely Dewatered
37	51981	PER				13	33N	52E	23	SW	SW	MUN	2.000	735.57	Carlin - City of	
56	35107	CER				<10	33N	52E	33	NE	NE	IRR	0.897	101.97	Jones, Melvin R.; Jones, Rachel S.	
62	52266	PER	165	649	484	<10	33N	52E	27	NE	NW	MUN	0.560	405.58	Carlin - City of	
64	28197	CER				10	36N	50E	30	NW	SE	MM	0.140	96.83	Polar Resources Company	
65	30615	CER	NR	243		48	35N	50E	10	SW	SE	MM	0.160	64.29	Polar Resources Company	Impacted
135	23881	CER				48	35N	50E	22	NW	NW	STK	0.045	5.10	Newmont Gold Company	Impacted
143	28969	CER	10228			10	34N	50E	19	NW	NW	STK	0.012	17.93	Elko Land and Livestock, Co.	
Application for Water Rights Inside 10-foot Drawdown Contour																
1	36901	RFP					33N	52E	12	NE	SW	IRR	5.400	N.S.	Jefferson, Thomas F.	Application Only
4	36994	RFP					33N	52E	12	NW	NE	IRR	5.400	N.S.	Johnson, Ernest W.	Application Only
6	36996	RFA					34N	52E	36	NE	SE	IRR	5.400	N.S.	Boyer, David E.	Application Only
9	36999	RFA					33N	52E	1	SW	NE	IRR	5.400	N.S.	Salley, Curtis R.	Application Only

N/A = not applicable. N.S. - Not Specified

1 CER= Certificate; PER= Permit; RFA= Ready for Action; RFP= Ready for Action (Protested); NP = no water right permit required obtained for use.

2 SWL = approximated static water level as feet below ground surface based on well log information; NR = not reported.

3 Depth of bottom of screened interval in feet below ground surface.

4 Sec = section; TN = township north; RE = range east; QTR = quarter section; QQ = quarter quarter section.

5 IRR = irrigation; STK = stock; DOM = domestic; IND = industrial; IRR = irrigation; MUN = municipal; ENV = environmental; QM quasi-municipal; REC = recreation; MM = mining and milling; COM = commercial; OTH = other.

to ten feet was predicted in 1993); therefore, use of these wells should not be significantly impacted. The Carlin "Cold" Spring system used as a public water supply source in Carlin is discussed below.

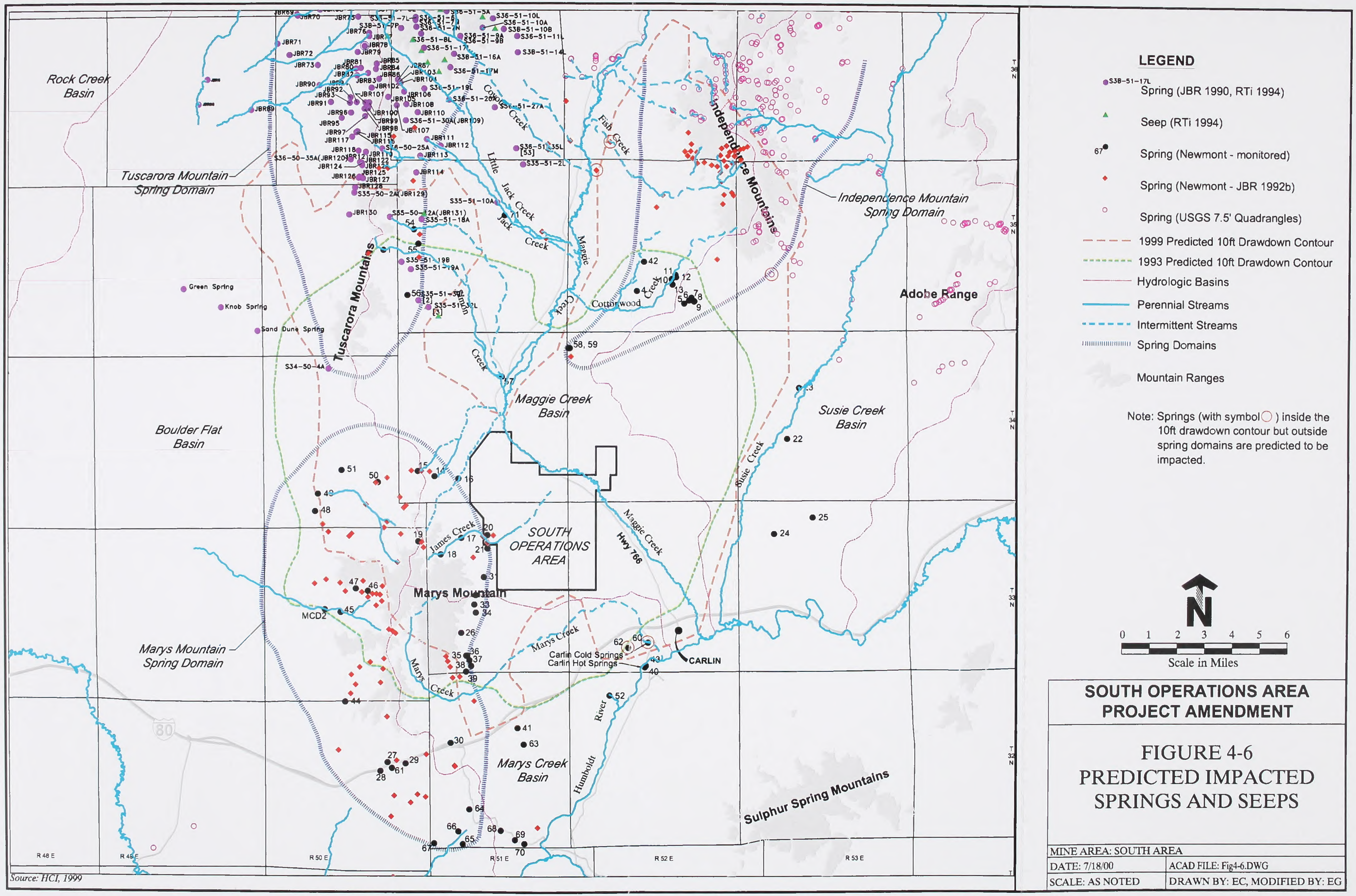
Impacts on Springs and Seeps

There are numerous springs and seeps in the South Operations study area that are important to the area's ecosystem (see Chapter 3, Water Resources). Springs are categorized into two main types: (1) springs located primarily in mountainous areas fed by perched aquifers separated from the water table system due to elevation and geologic conditions, and (2) water table springs associated with regional groundwater systems and generally located at lower elevations. This division is generalized and there may be some mixture of spring types in the mountain and valley areas.

The perched springs in mountainous areas are divided into three spring "domains" (Marys Mountain, Tuscarora Mountains, and Independence Mountains), which represent the general area of mountain springs in the study area (**Figure 4-6**). Surface traces of the Tuscarora fault zone and other basin-bounding structures help define the mountain spring domains in the Maggie Creek Basin. Generally, perched springs located within the mountain domain areas would not be affected by mine dewatering. An exception might be springs with a deep bedrock source. Several springs in the Marys Mountain and Independence Mountain domains appear to be associated with a deep bedrock groundwater and the source could potentially be impacted by mine dewatering. Springs not located within the domains generally are associated with the regional water table system that would be intercepted and dewatered by the Gold Quarry Mine.

The highlands area located to the west and southwest of the Gold Quarry Mine includes the southern portion of the Tuscarora Mountains and the Marys Mountain area (**Figure 4-6**). For this discussion, this area is informally referred to as the Marys Mountain block. As illustrated in **Figure 4-6**, numerous springs are located within the Marys Mountain block; however, water-level data from bedrock wells in this area are sparse. As shown in **Figure 4-5**, three monitoring wells are located within or near the flanks of the mountain block. These three wells indicate that ground water levels are at an elevation of approximately 6,000 feet and are near-surface or artesian (with measured water pressures equivalent to water-level elevations above the ground surface). A series of springs that issue from the bedrock along the eastern flank of the Marys Mountains occur at an elevation of approximately 6,000 feet, similar to the water-level elevations measured in the nearby wells. The water quality of the springs and wells is a similar calcium bicarbonate type with relatively low concentrations of total dissolved solids and neutral to slightly alkaline pH. Limited oxygen isotope data from several of these springs indicate a relatively fresh water and similar recharge source (Newmont, 1999c).

Ground water flow is assumed to be complex across this area. (It is conceivable that the spring domain within the Marys Mountain block could be controlled by localized perched ground water systems.) Since mine dewatering is predicted to eventually lower the heads in the deep bedrock system underlying the Marys Mountain block area, several springs in this area potentially could be impacted by drawdown. This includes the series of springs located along the eastern flank of the Marys Mountains, discussed in the previous paragraph, and springs located



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-6
PREDICTED IMPACTED SPRINGS AND SEEPS

MINE AREA: SOUTH AREA	
DATE: 7/18/00	ACAD FILE: Fig4-6.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY: EG

below an elevation of 6,000 feet. The potential for impacts to other springs above 6,000 feet elevation is considered low. To date, no impacts to springs in the Marys Mountain block area have been recorded.

Several studies support the separation into perched mountain springs and regional water table springs. Two recent studies investigated source and age of water for springs in the Carlin Trend area (Maurer et al., 1996; and Plume, 1994). Tritium levels were measured on eight springs. High tritium levels indicate that water was recently recharged from the atmosphere. Springs with high tritium levels are commonly associated with the higher perched mountain domain springs. Four springs at or below 5,000 feet elevation had tritium levels below detection limits, and are therefore associated with a deeper aquifer where water has been in storage much longer (including Newmont monitored springs No. 40 and 52). The remaining springs ranging in elevation from 4,930 feet elevation to 6,030 feet elevation had tritium levels indicating that the recharge water was younger than 60 years (including Newmont monitored springs No. 2, 34, and 60). This indicates that springs between 5,000 and 6,000 feet are possibly associated with perched mountain aquifers. An elevation of 6,000 feet is believed to be a general division between the higher perched springs and the lower water table springs (Balleau Groundwater Consulting, 1992). Water chemistry data including stable isotopes (deuterium and oxygen O^{18}), tritium, strontium, specific conductance, and chloride also indicate physical separation of the perched and water table flow systems (Balleau Groundwater Consulting, 1992; Zimmerman, 1992b). These data reflect the source and age of water from the springs and seeps.

In addition, the eastern boundaries of the Tuscarora and Marys Mountain spring domains coincide closely with an elevation of 6,000 feet. The Tuscarora Fault and associated faults along the east side of the Tuscarora Mountains in the South Operations area behave as hydrologic barriers to pumping activities at the Gold Quarry Mine. Drawdowns of several hundred feet have been observed in wells east of the fault system, whereas most wells west of the faults have shown no response to pumping at the Gold Quarry Mine (HCI, 1999, Appendix C).

Biannual surveys of selected springs have been conducted by Newmont since 1993 to establish baseline conditions (Newmont, 1999b). These surveys include flow measurements, water quality sampling and analysis, and vegetation description. The spring water chemistry data collected by Newmont do not confirm nor contradict the differentiation of springs into separate groundwater systems. The water chemistry of all springs is fairly similar, and no tritium data were collected. No significant effects on monitored spring flows were found due to Gold Quarry pit dewatering from the beginning of monitoring through Spring 1999. Anecdotal evidence exists of a thermal spring, or a group of thermal springs at the mouth of Maggie Creek Canyon. These springs, however, dried up before 1990, before spring monitoring began (Pettit, 1998).

Figure 4-6 shows maximum extent of the 10-foot drawdown contour line associated with the cone of depression resulting from dewatering at the Gold Quarry Mine (HCI, 1999). Springs and seeps located within this contour line that are not part of the perched spring domains are most likely to be impacted by Gold Quarry Mine dewatering. Some of these springs, however, are located adjacent to

the spring domain boundaries and may be associated with the perched spring system. Magnitude of impact on any affected spring can vary from minor reduction in flow to complete elimination of flow. Location of each spring or seep in relation to the cone of depression and the spring's water pressure or head would determine, in part, the magnitude of impact.

Newmont would mitigate documented lost flows at springs or seeps by one of two means: replacement of flow or provision of substitute water sources at nearby locations. Where impacted springs or seeps support sizable riparian areas or provide flow to adjacent creeks, replacement of flow would be implemented through the use of new water wells drilled at or near the affected spring. Flow replacement would be done such that the primary function of unimpacted spring and seep flow is maintained. Where impacted springs and seeps do not serve those functions, but are important sources of water for terrestrial wildlife, substitute water sources would be provided through the use of guzzlers. In areas where springs and seeps are in proximity to one another, a single well or guzzler may be utilized to mitigate several impacted water sources.

Following the above definitions of locational relationships between the spring domains and the predicted 10-foot drawdown contour, the following prediction of spring impacts can be made.

A total of 5 spring and seep sites is presumed to be potentially impacted by the expansion of the cone of depression. **Table 4-2** presents the potentially affected springs/seeps that were not analyzed in the 1993 EIS (BLM, 1993) (25 sites were identified in that analysis).

The numerical hydrogeologic model indicates a baseflow reduction in lower Marys Creek. Flows at the Carlin "Cold" Spring (Carlin Water Supply source) would be reduced by about 1.7 cfs gradually during the dewatering period (HCI, 1999). The maximum decrease would be expected to occur around the year 2030. The Carlin Hot Spring (Spring #43) located adjacent to the Humboldt River just west of Carlin is not projected to be impacted. The Carlin Cold Spring (Spring #60) is located exactly on the 10-foot drawdown contour; the Carlin Hot Spring is located outside, but near the 10-foot drawdown contour. Since both springs are of concern, they would continue to be monitored.

Quality of spring and seep water is not expected to be affected by the SOAPA dewatering operations. No significant changes in the hydrogeologic system that controls water quality would occur as a result of the Proposed Action. Predicted mine pit water quality after cessation of mining is discussed in a later section. Following the year 2011, impacted spring and seep flows would begin to approach pre-mining conditions as groundwater levels begin to rise. Complete recovery of some springs and seeps may never occur, or take more than 100 years. While it is not possible to specify which springs or seeps would be affected, those closest to the project area would have the greatest probability of being impacted. Maximum impacts on springs and seeps would occur roughly between years 2000 and 2050 (HCI, 1999).

Impacts on Baseflow

Baseflow in some streams within the study area would decrease as a result of Gold Quarry Mine dewatering operations. Baseflow in lower Maggie Creek and the Humboldt River

TABLE 4-2
SPRINGS AND SEEPS WITHIN THE INCREMENTAL 10-FOOT DRAWDOWN CONTOUR OF GOLD QUARRY MINE DEWATERING

Location[1] TN/RE - Section - 1/4,1/4	Newmont Inventory No.[2]	Elevation (feet)	Developed[3]	Comments
36/52-32-NE				Fish Creek drainage
35/53-20-SW				USGS mapped spring
33/52-28-SW, SE	Spring 60		Developed	Carlin Cold Springs
33/52-28-SW, SW	Spring 62			
35/52-6-NE, SE				Adjacent to Maggie Creek

[1] TN = township north; RE = range east; 1/4 section of 1/4 section.
[2] Spring number assigned by Newmont as part of its periodic monitoring program; see Chapter 3, Water Resources.
[3] Developed means that spring/seep has undergone a man-made modification, primarily for stock watering purposes.

would increase during the dewatering period as a result of water discharged directly to Maggie Creek below Maggie Creek Canyon from the dewatering operations and the Maggie Creek Ranch Reservoir. Baseflow is defined as streamflow during the late fall and early winter period when agricultural diversions, runoff, and evapotranspiration are minimized and flow is primarily from groundwater contributions which are not influenced by seasonal runoff in Nevada. Baseflow measurements typically are made during the month of October. Baseflow would decrease in areas where the cone of depression intercepts groundwater that discharges naturally to the streams.

Reductions in baseflow can occur downstream of the 10-foot drawdown contour where groundwater flow that would discharge to streams is intercepted by the cone of depression. In the original EIS (BLM, 1993) dewatering rates as high as 42,000 gpm (100 cfs) were assumed based on the earliest modeling efforts. Model refinements and the current dewatering program have shown that lower rates are sufficient. The currently predicted maximum dewatering rate is 25,000 gpm (56 cfs)(HCI, 1999).

Average monthly flow in Maggie Creek before mining was approximately 100 cfs during April and May, and less than 10 cfs from July through January based on a 1913-1924 period of record (see **Table 3-6**). Bankfull capacity of Maggie Creek below the canyon is approximately 80 cfs (35,900 gpm) (Rosgen, 1992). Maximum flow recorded on Maggie Creek before mining was 2,440 cfs (1,095,000 gpm) on February 12, 1962 (Schroer and Moosburner, 1978).

Currently, water is discharged to lower Maggie Creek, except during periods of natural high flows in Maggie Creek. In 1998, more than 18,500 acre feet were discharged into Maggie Creek (25.5 cfs/11,400 gpm). Discharge would continue through the dewatering period until 2011 at rates of less than 65 cfs (29,200 gpm). The maximum rate of 65 cfs is based on a predicted maximum dewatering rate of 55 cfs (25,000 gpm) plus an average discharge rate from the reservoir of 10 cfs (4,500 gpm). The BLM (1993) analyzed discharge rates of up to 104 cfs (46,700 gpm). Some water infiltrates through the Maggie Creek channel and recharges the underlying alluvial groundwater system during the period of mine water discharge to Maggie Creek.

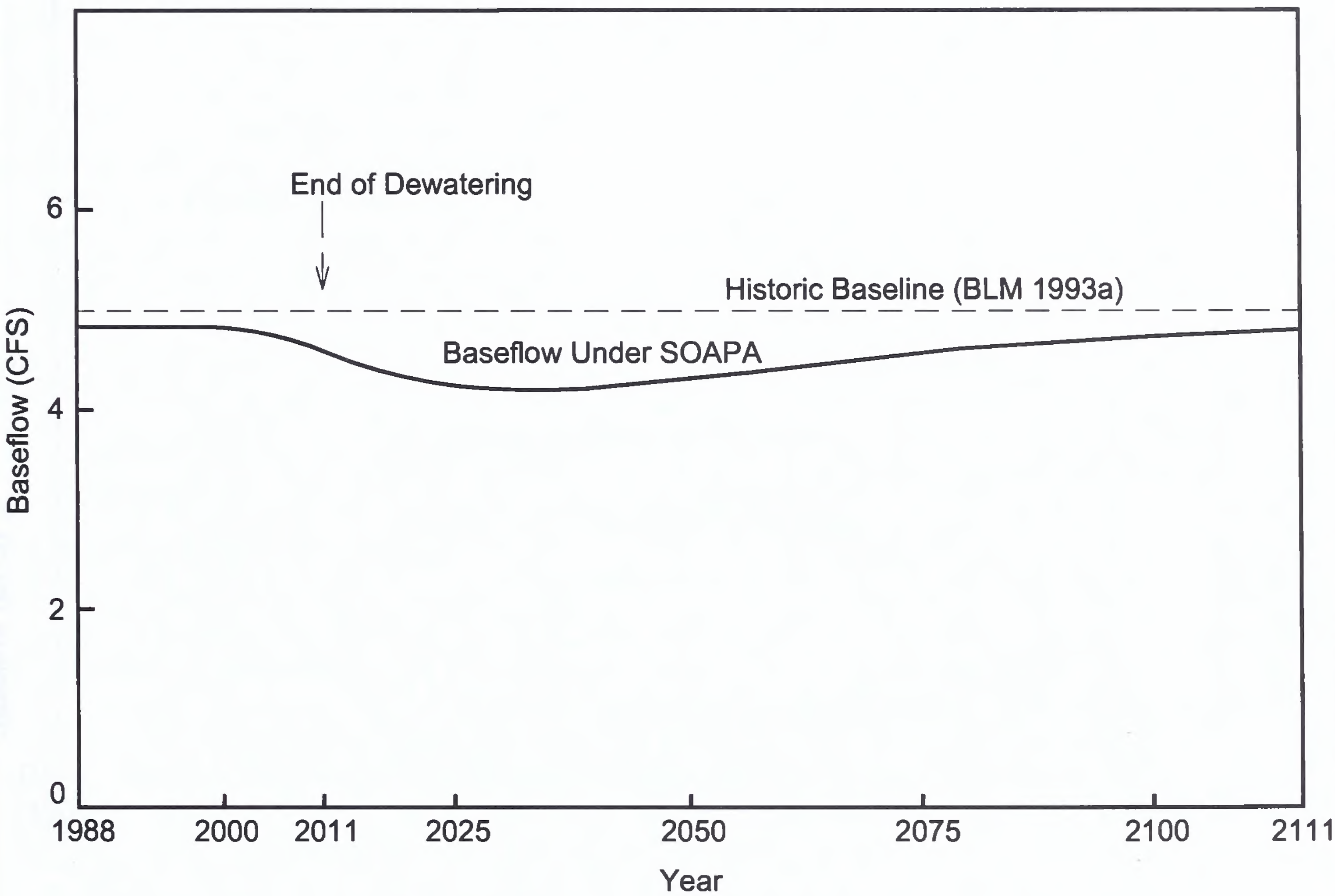
When dewatering and associated discharge cease, baseflow of Maggie Creek would decline as a result of the cone of depression that extends over a portion of the Maggie Creek Basin (**Figure 4-3**). At the gaging station located on Maggie Creek just below the canyon, flow generally is less than 4 cfs (1,800 gpm) or absent during the period July through October.

Baseflow in upper Maggie Creek from Jack Creek to the upper end of Maggie Creek Canyon would be temporarily reduced by about 0.6 cfs (269 gpm) after cessation of dewatering (HCI, 1999) (**Figure 4-7**). The temporary reduction in 1993 was estimated at 2-4 cfs (BLM, 1993). Impacts would be associated primarily with a reduction in baseflow for the reach immediately above the Maggie Creek Canyon. Maximum reductions in Maggie Creek baseflow are predicted to occur around 2040, followed by a gradual increase in baseflow (**Figure 4-7**).

Lower Maggie Creek is naturally intermittent and loses flow below the canyon. Shortly after mine water disposal ceases, lower Maggie Creek would again be dry during baseflow conditions (**Figure 4-8**) (HCI, 1999). This would occur under the original plans (BLM, 1993) as well as for the extended mining period proposed by SOAPA. Maggie Creek is naturally dry during the summer months in dry years.

Several tributaries to Maggie Creek have portions of their length located within the incremental 10-foot drawdown contour (**Figure 4-1**). Upper reaches of these streams above approximately 6,000 feet generally are perennial, flowing continuously due to springs in the mountain areas. For many of the tributaries north of Maggie Creek Canyon, the springs feeding the streams are in the Tuscarora or Independence Mountain Spring domains. The lower reaches of these streams are ephemeral or intermittent and generally flow only in response to snowmelt runoff and precipitation. These piedmont areas are major zones of recharge to the groundwater system (Berger, 1999). Some springs in the lower reaches of these streams provide continuous flow to short segments. Baseflow in portions of these streams may be reduced or lost for a period during and after dewatering at the South Operations area.

A short reach of lower Susie Creek will continue to be dry during the fall/winter months. This reach is located above Interstate-80 and extends from the USGS gaging station approximately one mile upstream. Susie Creek is predicted to have maximum baseflow reductions due to SOAPA dewatering from approximately 2025 to 2065. Baseflow in the remainder of the creek is predicted to recover subsequently to within 0.05 cfs of pre-mining conditions (HCI, 1999) (**Figure 4-9**). The BLM (1993) analyzed a decrease in baseflow of 0.5 cfs. However, Susie Creek also loses flow normally in its lower reaches and is periodically dry in this area. Average annual flow measured in Susie Creek approximately 16 miles above its mouth during the period 1956-58 was 6 cfs, with average monthly flows ranging from 0.11 to 29.3 cfs (USGS, 1963). Historic baseflow of Susie Creek at this location was modeled at about 0.8 cfs (HCI, 1992), and a baseflow of 0.7 cfs was used in the 1999 modeling (HCI, 1999).

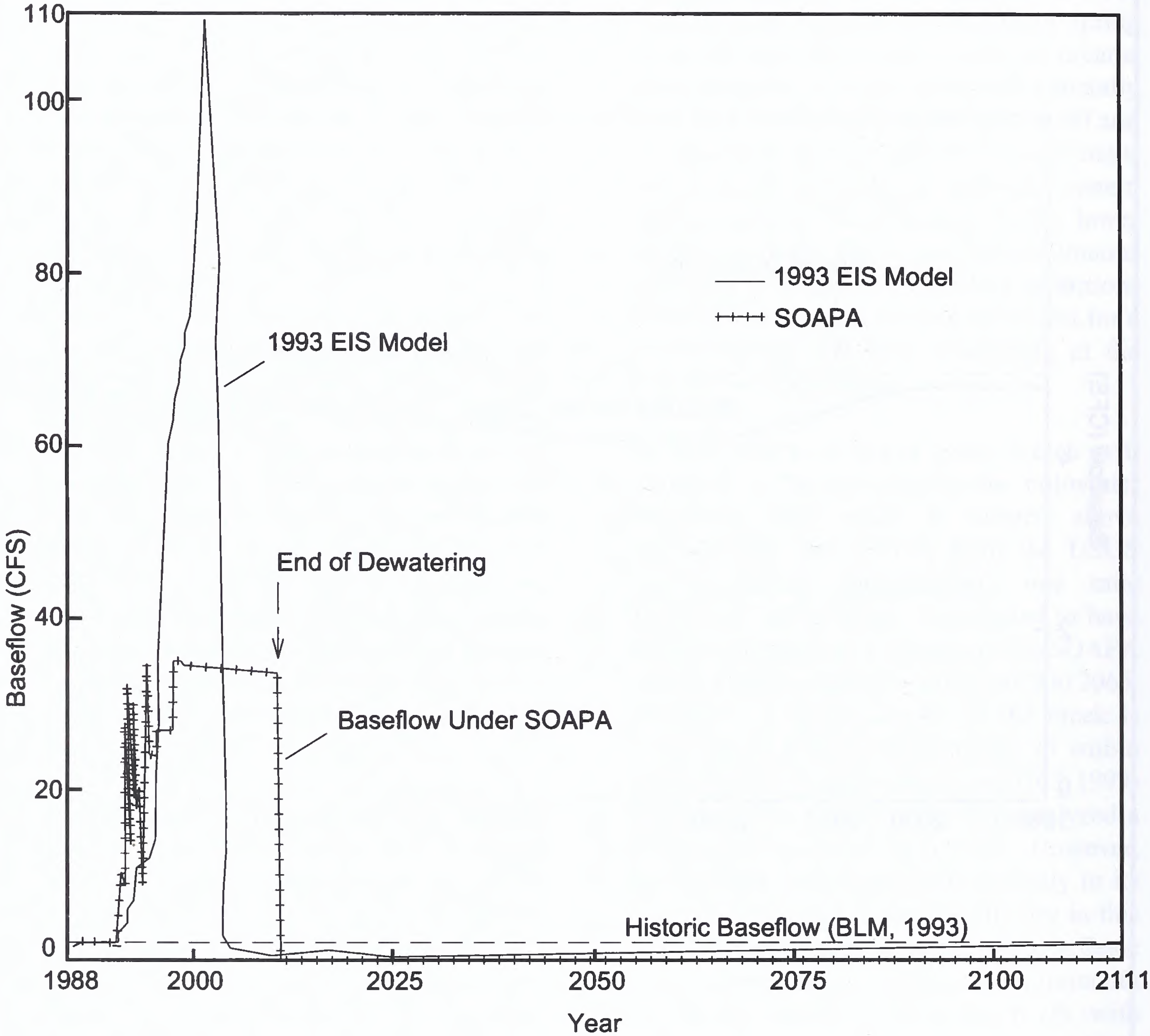


SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-7
PREDICTED BASEFLOW IN UPPER MAGGIE CREEK

DATE: 6/6/00	ACAD FILE: Fig4-7.DWG
SCALE: NTS	DRAWN BY: ML, MODIFIED BY EG

Source: HCI, 1999.

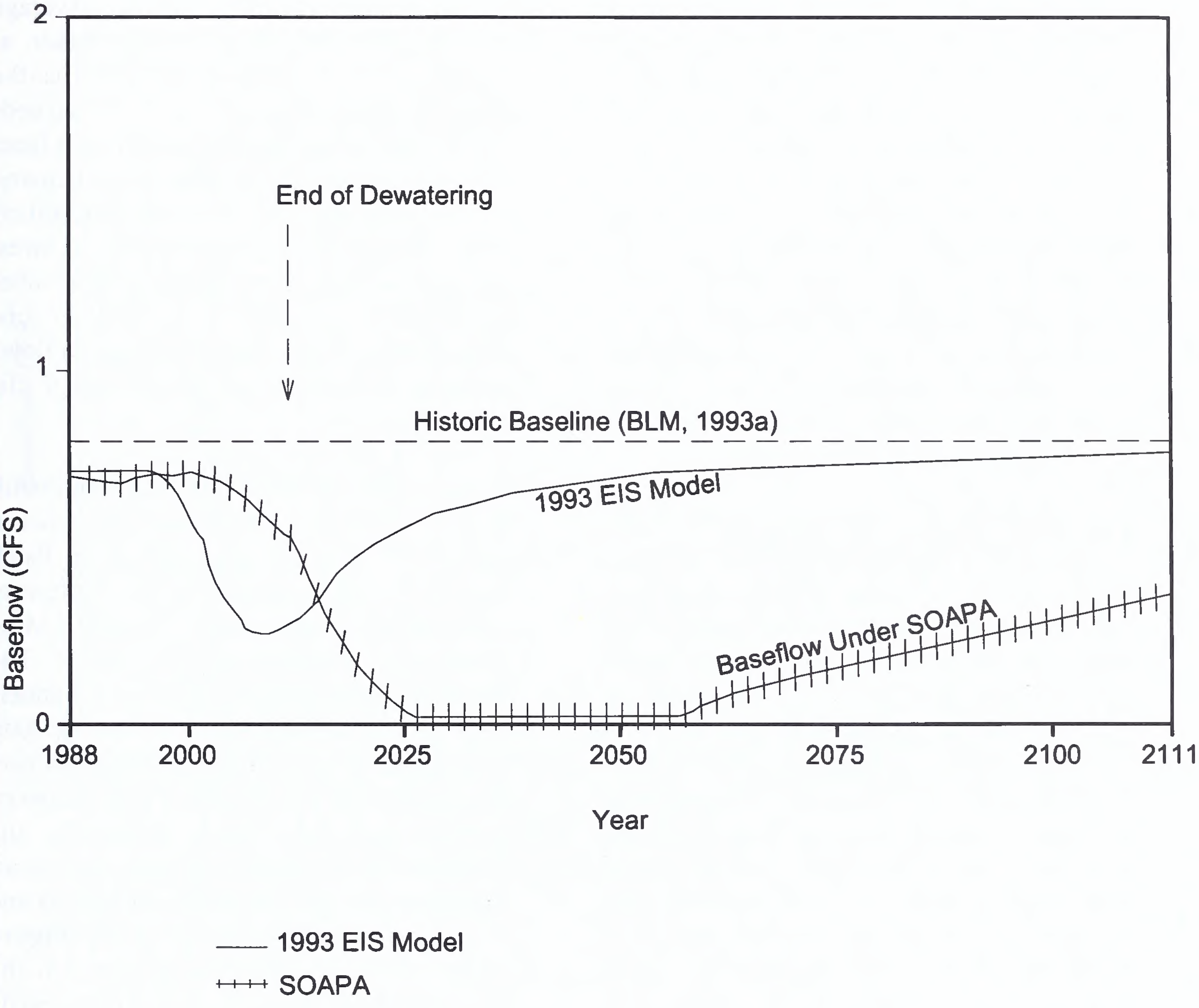


Source: HCI, 1999.

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-8
PREDICTED BASEFLOW
IN LOWER
MAGGIE CREEK

DATE: 6/6/00	ACAD FILE: Fig4-8.DWG
SCALE: NTS	DRAWN BY: ML, MODIFIED BY EG



Source: HCI, 1999.

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-9
PREDICTED BASEFLOW IN LOWER SUSIE CREEK NEAR CONFLUENCE WITH HUMBOLDT RIVER

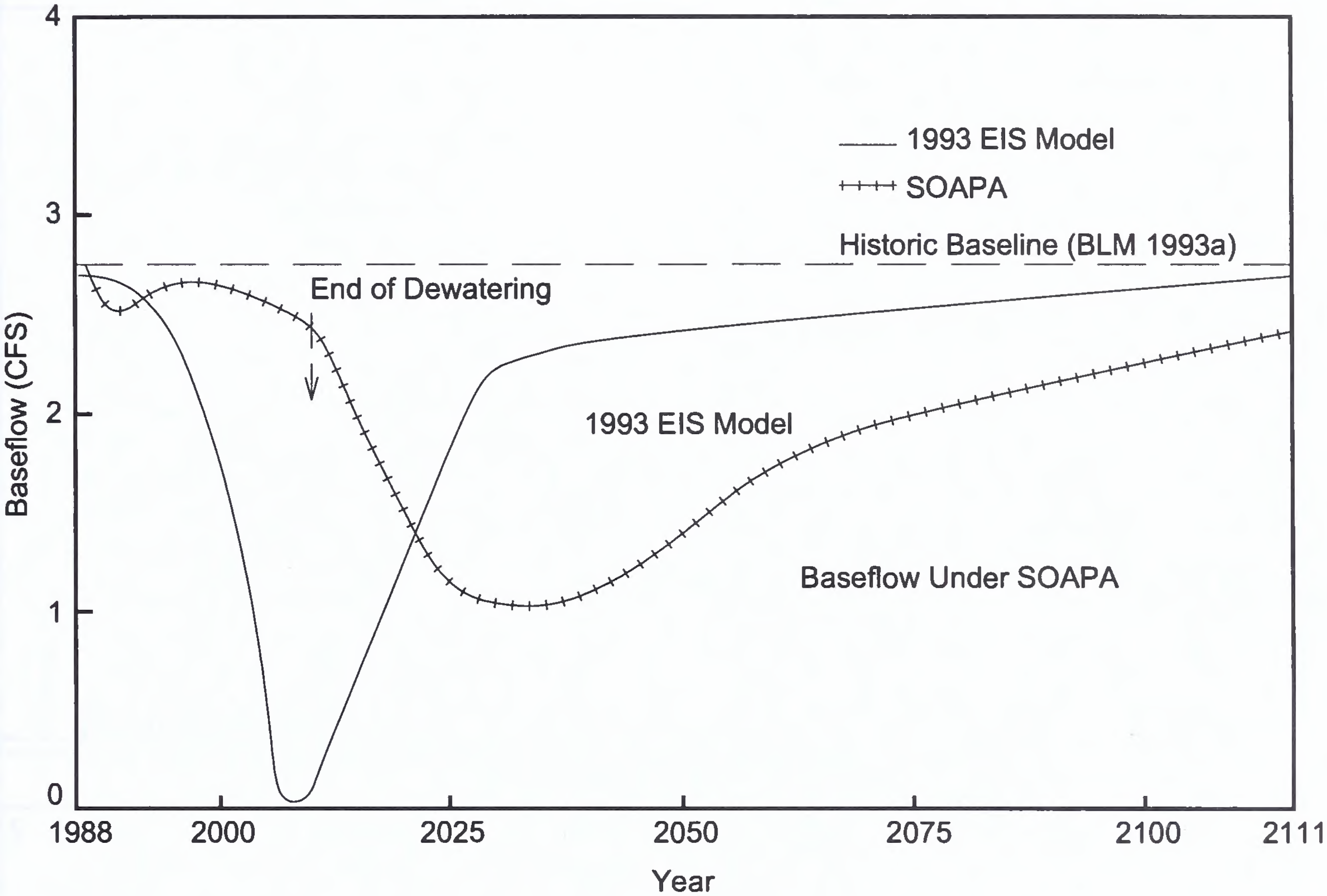
DATE: 6/6/00	ACAD FILE: Fig4-9.DWG
SCALE: NTS	DRAWN BY: ML, MODIFIED BY EG

In 1993, Newmont committed to augment baseflow in Susie Creek if groundwater levels in monitoring wells fall to less than one foot above the elevation of the bed of Susie Creek, or if flows have fallen below 0.8 cfs, and monitoring confirms these levels and BLM concurs. Two piezometers and two surface flow measurement sites would be used to determine the need for augmentation. Augmentation will consist of maintaining minimum flows as specified in the Susie Creek Augmentation Plan (BLM, 1993). Augmentation would be provided by the drilling of one or more wells in the area of the most upstream sampling site (SCS-1) and pumping water to low velocity transmitters in the creek bed via buried pipeline.

The predicted effect on baseflow in lower Marys Creek is shown in **Figure 4-10**. Flow at the mouth of Marys Creek generally consists almost entirely of discharge from the Carlin "Cold" Springs. The numerical model predicts that baseflow near the mouth of Marys Creek would decrease by as much as 1.7 cfs during dewatering (HCI, 1999), reducing flow at the Carlin "Cold" Spring complex. Impacts on flow in lower Marys Creek (i.e., the Carlin "Cold" Springs) would be greatest in about year 2030, followed by a gradual return to pre-mining conditions (**Figure 4-10**). Previous analysis (HCI, 1992) indicated as much as a 2.6 cfs reduction in baseflow in Marys Creek. Average annual flow of Marys Creek at its confluence with the Humboldt River during some very dry years before mining at Gold Quarry (prior to 1985) was around 3.0 cfs. Average annual flows for the period from 1989 to 1998 ranged from 2.8 to 12 cfs. No impact on ephemeral flow in upper Marys Creek is expected from dewatering because the sources of this surface water are primarily precipitation and perched springs in the vicinity of Marys Mountain.

Flow in the Humboldt River between the Carlin and Dunphy Gages is currently being augmented by mine water discharged to Maggie Creek (**Figure 4-11**). Average monthly flow in the Humboldt River at Palisade (between Carlin and Dunphy) has the following general characteristics: (1) exceeds 500 cfs during the period March through June; (2) ranges from 100 to 500 cfs in January, February, and July; and (3) is less than 100 cfs from August through December. Lowest average monthly flow occurs in September and October at rates of 32 and 47 cfs, respectively. Maximum and minimum flows recorded at Palisade are 17,000 and 9 cfs, respectively.

Newmont has evaluated flow in the Humboldt River before mining related discharge between the Carlin Tunnels gage and Rye Patch Reservoir to quantify the potential contribution from Gold Quarry Mine dewatering discharge (HCI, 1997). The Humboldt River between the Carlin Tunnels and Palisade gages has an annual average gain in flow of 51 cfs and an average baseflow gain (October) of 18 cfs (**Figure 4-12**). Between Palisade and Rye Patch Reservoir, the Humboldt River has natural gains and losses but has an average annual loss of 126 cfs and an average baseflow loss of 15 cfs (**Figure 4-12**). The addition of mine water to the Humboldt River, therefore, would temporarily help offset reductions in flow that occur naturally in the Humboldt River downstream of Palisade. The magnitude of changes in river baseflow that would occur and the length of stream that would be affected below Palisade are difficult to predict because of complex river dynamics, including inflow, outflow, bank storage, evapotranspi-ration, and irrigation withdrawals. **Figure 4-13** is a representative cross-section showing excess mine discharge water plotted with baseflow

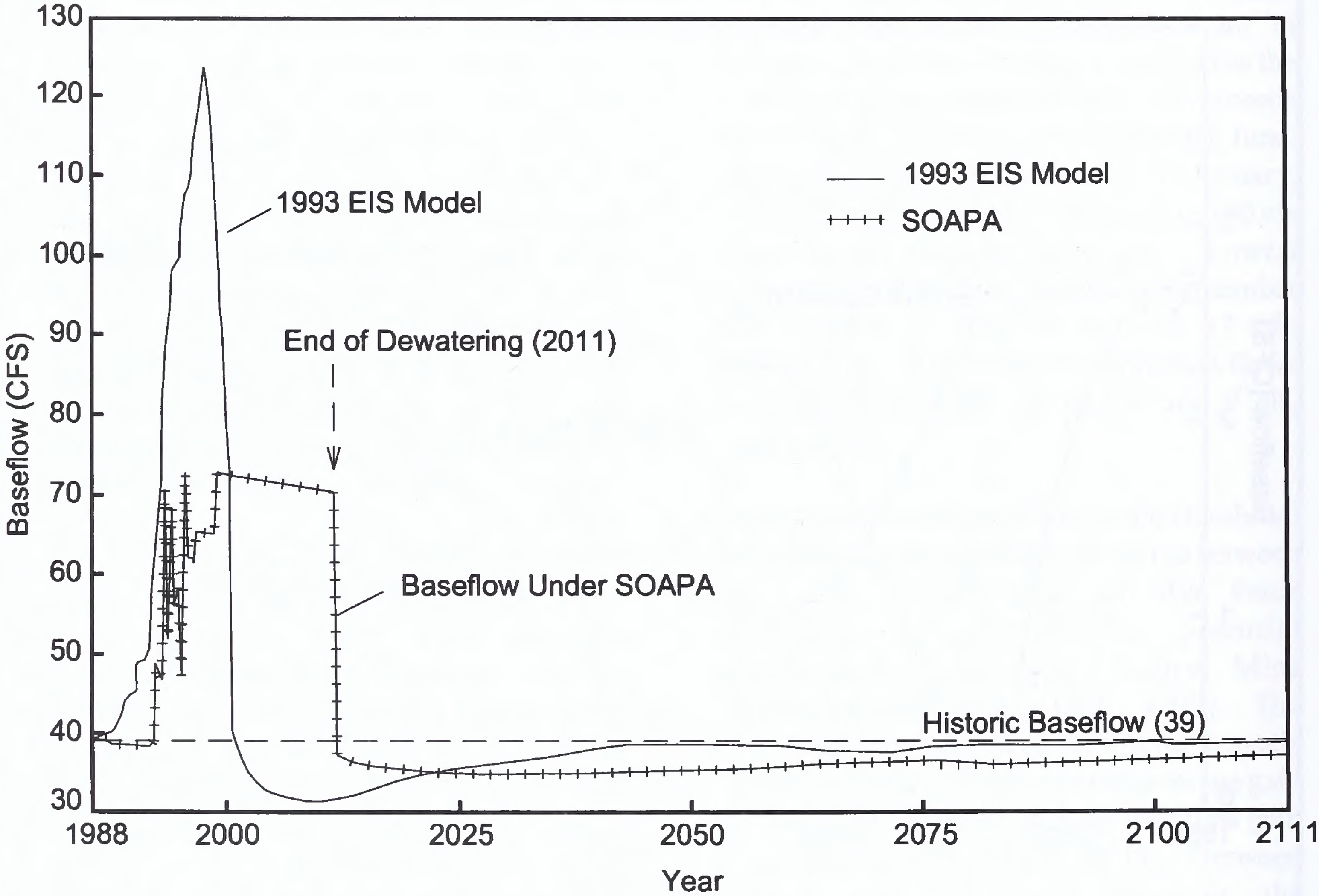


Source: HCI, 1999.

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-10
PREDICTED BASEFLOW IN MARYS CREEK (CARLIN SPRING)

DATE: 4/12/00	ACAD FILE: Fig4-10.DWG
SCALE: NTS	DRAWN BY: ML, MODIFIED BY EG

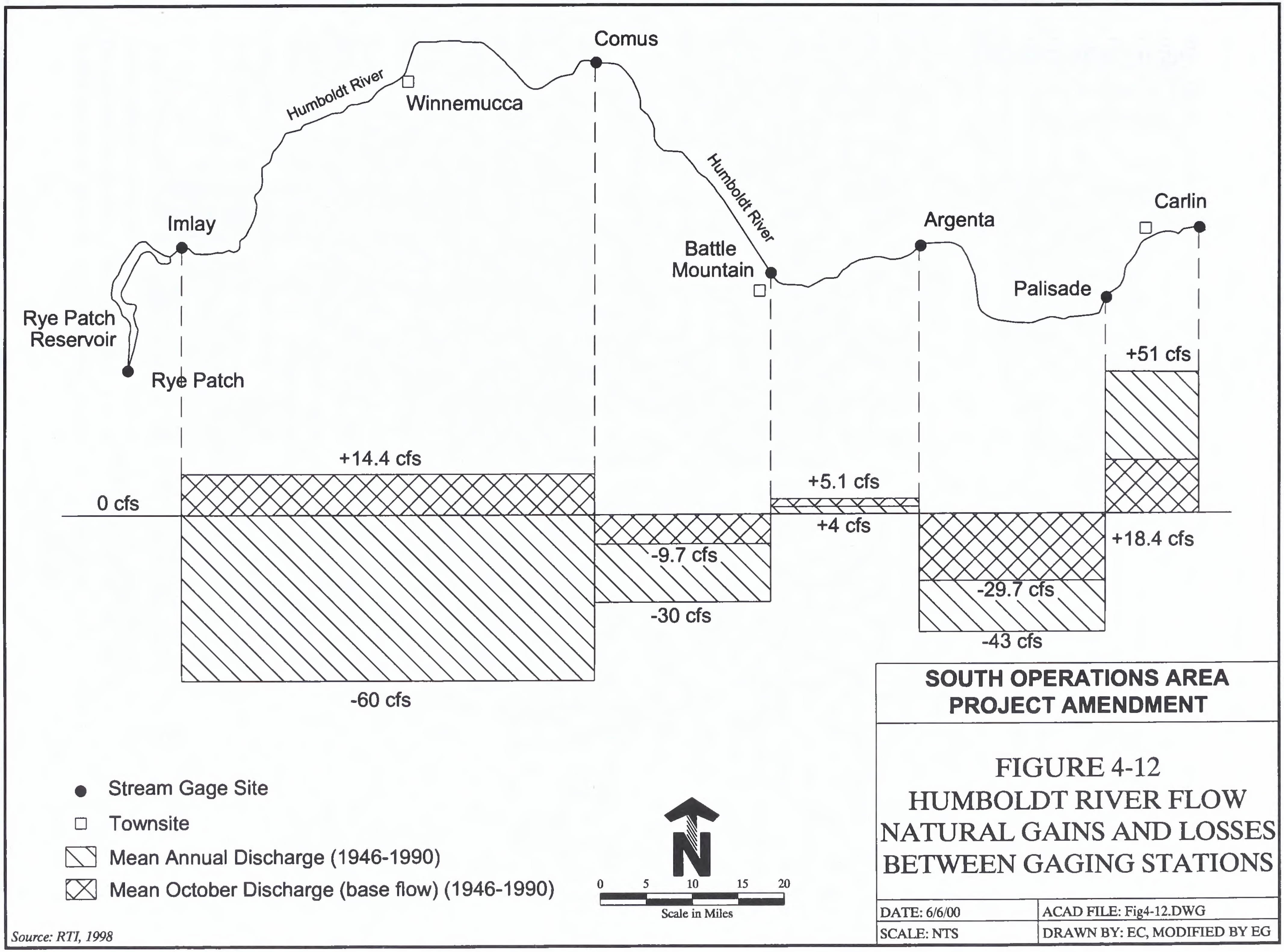


Source: HCI, 1999.

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-11
PREDICTED BASEFLOW IN HUMBOLDT RIVER AT DUNPHY

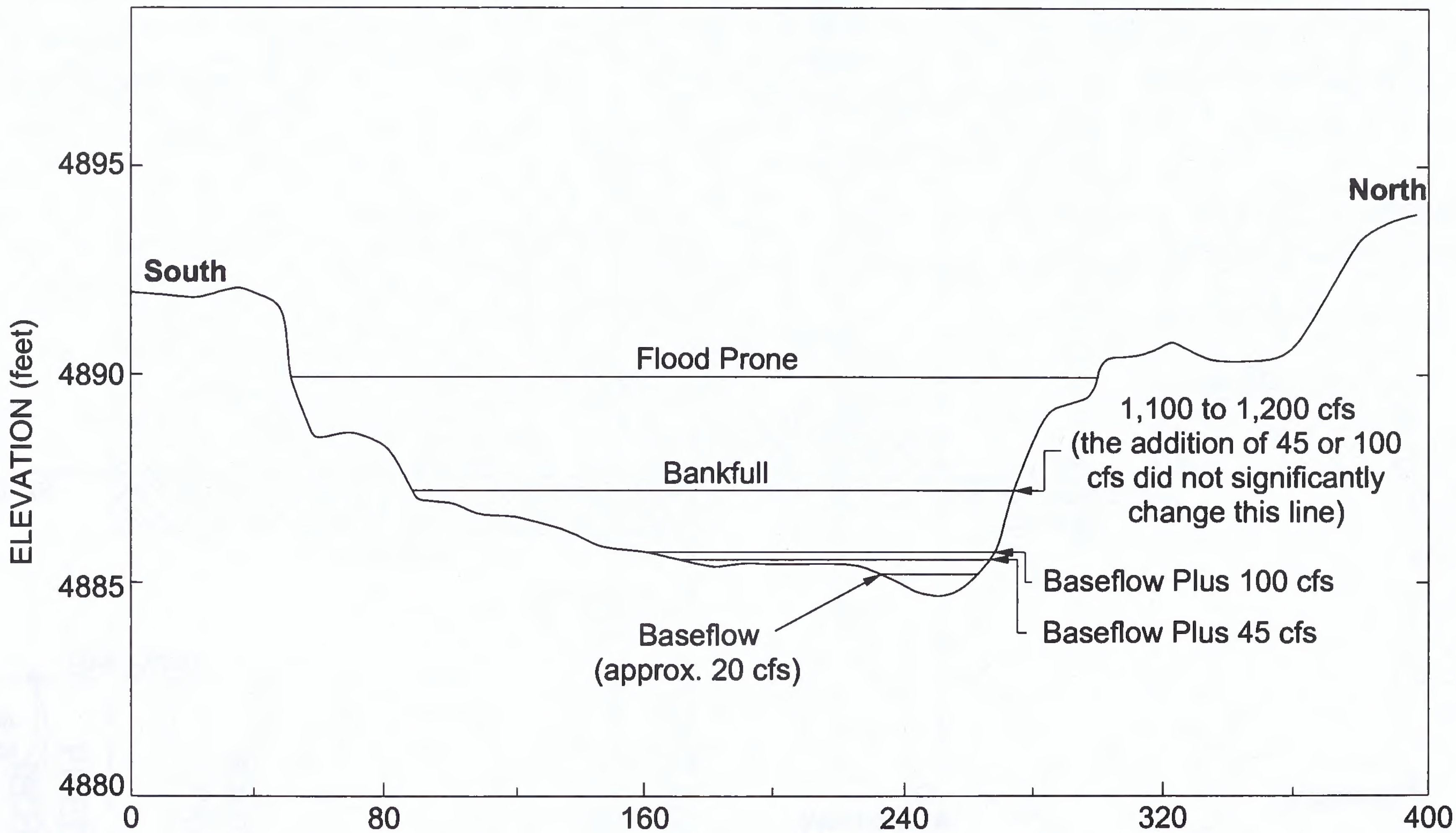
DATE: 6/27/00	ACAD FILE: Fig4-11.DWG
SCALE: NTS	DRAWN BY: ML, MODIFIED BY EG



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-12
HUMBOLDT RIVER FLOW NATURAL GAINS AND LOSSES BETWEEN GAGING STATIONS

DATE: 6/6/00	ACAD FILE: Fig4-12.DWG
SCALE: NTS	DRAWN BY: EC, MODIFIED BY EG



*Cross-Section Approximately 100 Yards Downstream From Maggie Creek, Looking Downstream

Source: Rosgen, 1992 as seen in BLM, 1993.

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-13
HUMBOLDT RIVER
CROSS-SECTION

DATE: 6/6/00	ACAD FILE: Fig4-13.DWG
SCALE: NTS	DRAWN BY: EC, MODIFIED BY DS

and bankfull flow in the Humboldt River immediately downstream from the Maggie Creek confluence. This flow increase in the Humboldt River is well within the active channel for low and moderate flows, and is nearly undetectable during high flows. As mentioned previously, during very high flows, mine discharge is routed to the Maggie Creek Ranch Reservoir.

Humboldt River baseflows after cessation of dewatering are estimated to decrease by a maximum of 4.9 cfs between Carlin and Dunphy gages (HCI, 1999) (**Figure 4-11**). The largest reduction is predicted to occur about the year 2030. The long term decrease in baseflow between the Carlin and Dunphy gages is predicted to be about 1.5 cfs (HCI, 1999). The BLM (1993) previously analyzed a maximum decrease of 19 cfs for that reach.

Surface Water Rights

Drawdowns of groundwater would have potential impacts on surface water flows, and therefore on the availability of water to satisfy surface water rights. There are 12 permits and certificates for surface water rights and vested water rights inside the 10-foot drawdown boundary (**Table 4-3** and **Figure 4-14**).

If surface flows are reduced to the point where surface water rights cannot be satisfied, the agricultural (grazing) or industrial uses (mining) would have to be altered or suspended, or a supplemental water supply provided. The mines have numerous other water sources available to supplement any lost water rights. Ranchers may not have other water sources available to satisfy their reduced or lost water right. In such a case, Newmont has agreed to subjugate some of their senior water rights to provide supplemental water. Potential water losses to irrigation water rights holders in the middle and lower Humboldt sub-basins would be mitigated by Newmont informing the Water Master of Newmont's calculation of the amount of water potentially lost, and instructing the Water Master to administer a like amount of Newmont's senior decreed water rights within the basins as if they were the most junior water rights in the sub-basins for that irrigation season. Newmont owns or controls senior decreed water rights within these sub-basins in excess of the maximum potential baseflow impact. Newmont would use a calculation presented in the Mitigation Plan (BLM, 1993) to determine the estimated loss of baseflow prior to April 1 each year mitigation is required. Newmont and the Water Master would determine each year which particular Newmont water rights would be used for this purpose.

Stream and River Channel Stability

Channel characteristics of Maggie Creek and the Humboldt River are summarized in Chapter 3, Water Resources. The addition of excess mine water on a continuous basis to lower Maggie Creek and the Humboldt River could potentially result in increased erosion.

The Humboldt River is not expected to experience significantly increased erosion because of its large channel capacity and fair to moderate bank stability (JBR, 1992a). The Humboldt River has a channel capacity of at least 1,000 to 1,500 cfs in the vicinity of Carlin and Palisade (U.S. Army Corps of Engineers, 1950 and 1976).

While the majority of Maggie Creek is not entrenched, portions of the lower Maggie Creek channel are deeply entrenched and flows that exceed bankfull widths in those locations generally cannot be dispersed onto a floodplain (Rosgen, 1992). Bankfull discharge in Maggie Creek is approximately 80 cfs (159

TABLE 4-3
POSSIBLY IMPACTED SURFACE WATER RIGHTS

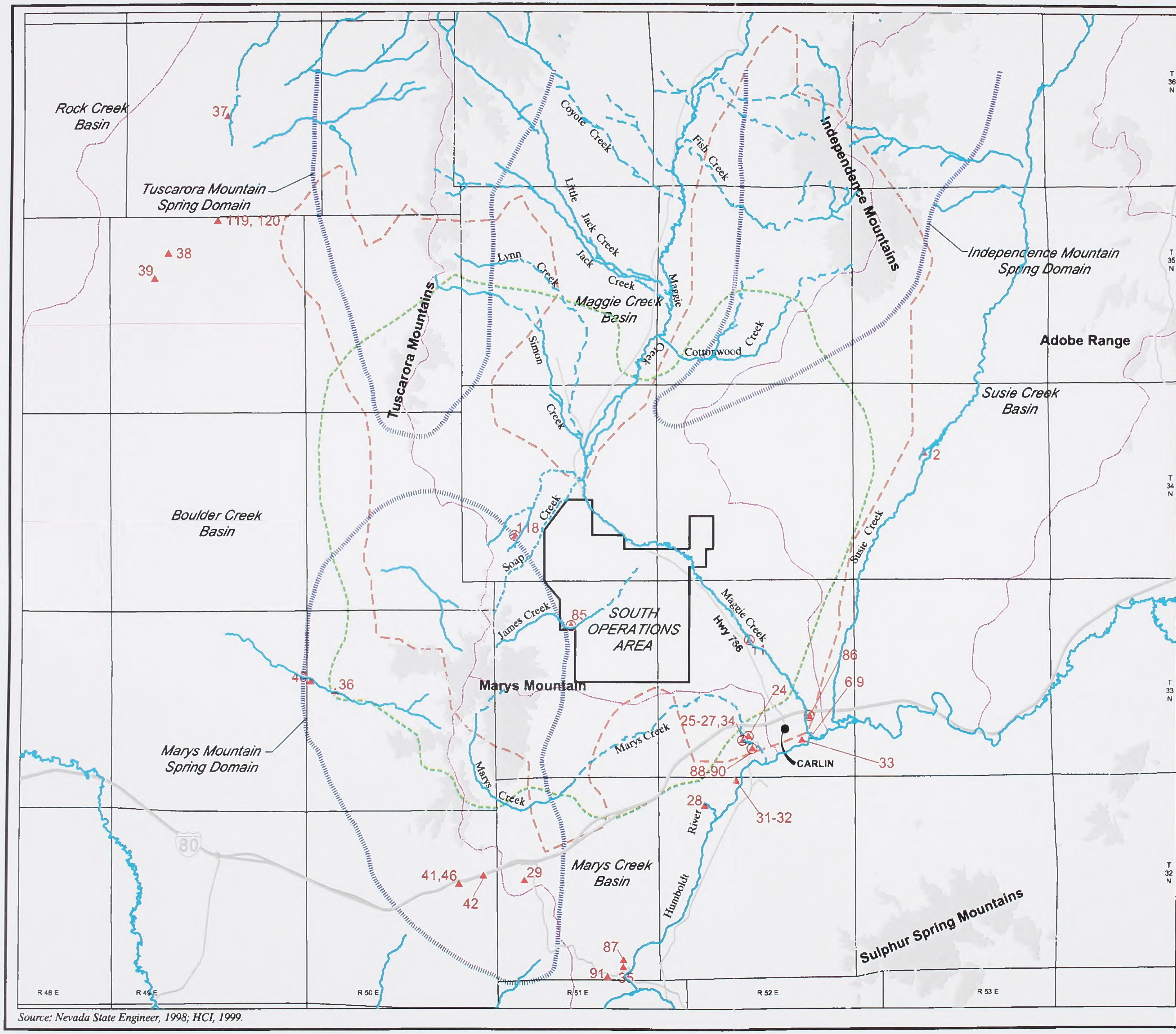
Map[1] #	App #	Status Permit/ Certificate[2]	Certificate Number	Township	Range	Section	Quarter	Use[3]	Diversion Rate (CFS)	Annual Duty (Acre-Feet)	Owner
Surface Water Rights within 10-foot drawdown contour											
11	18552	CER	6423	33N	52E	9	SE SE	IRR	5.143	809.9	Newmont Gold Company / Robert Hadley
24	50434	PER		33N	52E	28	SE	MUN	0.144	35.2	Carlin-City
25	50437	PER		33N	52E	28	SW SE	MUN	1.000	N.S.	Carlin-City
26	50438	PER		33N	52E	28	SW SE	MUN	3.000	N.S.	Carlin-City
27	50439	PER		33N	52E	28	SW SE	MUN	0.770	N.S.	Carlin-City
34	V01582	VST		33N	52E	28	SW SE	OTH	0.000	N.S.	Central Pacific Railway Co.
85	45509	CER	11660	33N	51E	10	SE NW	STK	0.346	84.2	Newmont Gold Company
86	63506	PER		33N	52E	26	NW NE	IRR	0.350	15.8	Newmont Gold Company
88	31214	CER	10430	33N	52E	33	NE NE	DEC	0.132	32.1	Jones, Melvin R.; Jones, Rachel S.
89	31215	CER	10431	33N	52E	33	NE NE	DEC	0.278	67.8	Jones, Melvin R.; Jones, Rachel S.
90	31216	CER	10432	33N	52E	33	NE NE	DEC	1.24	32.1	Jones, Melvin R.; Jones, Rachel S.
118	3474	CER	3609	34N	51E	29	SW SE	IRR		29.84	Charles Drake

[1]Refer to **Figure 4-14**

[2]Status:
- CER - Certificate
- PER - Permit
- RFA - Ready for Action
- VST - Vested Right

[3]Use:
- DEC - as Decreed
- IRR – Irrigation
- MUN - Municipal
- N.S. - Not Specified
- OTH - Other
- STK - Stock Watering

Note: Not listed are the following surface water rights: Springs that are tributary to the Humboldt river are considered appropriated, even if no specific right is recorded for them. Springs not tributary to the Humboldt River and on public land may be Public Water Reserves, which are reserved rights for livestock and domestic use.



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-14
PREDICTED IMPACTED SURFACE WATER RIGHTS

MINE AREA: SOUTH AREA	
DATE: 8/1/00	ACAD FILE: Fig4-14.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY EG

ac-ft. per day) as determined in the field and from a flood frequency curve for a 1.5-year return period (Rosgen, 1992). The zone of channel and bank saturation has increased during dewatering, contributing to instability. Streambank stabilization completed in 1994 was part of the South Operations Area Project Mitigation Plan (BLM, 1993).

Based on flow and sediment rating curves, Maggie Creek before mining had an average sediment yield of 1,980 tons per year, including both suspended and bedload sediment (Rosgen, 1992). Sediment load is generally evenly divided between suspended and bedload material. Concentrations of total suspended solids in Maggie Creek and the Humboldt River in the study area during the period 1990-97 ranged from below detection to 1,100 mg/L (5,400 tons per year) and below detection to 7,100 mg/L (35,100 tons per year), respectively (see **Table 3-8**). Relative changes in total suspended solids concentrations in the Humboldt River are higher during naturally low flow conditions when ambient sediment load in the river is low. No data on current sediment yield are available. The Proposed Action would not change total suspended solid concentrations or the sediment yield significantly above current levels, only the period of time during which water is discharged would increase. Lower Maggie Creek is characterized by the naturally high erodibility of its stream banks (Rosgen, 1992). To mitigate the potential effects of increased erosion and sediment transport, bank stabilization structures were designed and constructed at 29 locations in Maggie Creek in 1994 (Simons and Associates, 1994). The riprap revetment at the 29 locations has been designed for a flow rate of 130 cfs so that at flow rates lower than this, sediment transport from the bends is essentially reduced to zero. An inspection of lower Maggie Creek was conducted in the fall of 1997 (Hydro-Geo, 1997). The inspection revealed that the stabilization structures were performing as designed. High flows of up to 640 cfs (287,230 gpm) had not caused significant damage to the stabilization structures. Routine seasonal maintenance work was required at several locations. One location had a minor amount of bank caving and riprap movement. This location was also repaired as part of routine post-runoff season maintenance.

Mine dewatering flows of up to 17,400 gpm (38.9 cfs) in February 1997 had been managed using the current water management system. The SOAPA predicts flows of less than 23,800 gpm (65 cfs). This flow increase is within the capacity of the Maggie Creek Bank Stabilization structures and would not result in increased erosion and sediment production (Simons & Associates, 1997; Hydro-Geo, 1997). The original EIS (BLM, 1993) analyzed flows of 46,500 gpm (104 cfs).

At the point where dewatering discharge enters Maggie Creek, Newmont constructed a discharge structure to reduce the velocity of mine water. This prevents erosion at the discharge point due to increased flows.

Impacts on Water Temperature

Groundwater currently pumped from dewatering wells has an average temperature of about 30°C (86°F). Excess mine water is cooled and then discharged into Maggie Creek, from where it flows into the Humboldt River. As stated in Chapter 3, temperature of water in Maggie Creek and the Humboldt River varies considerably between seasons. Water temperatures in Maggie Creek and the Humboldt River are in the range of 0 to 30°C (32 to 86°F) (see **Table 3-10**). The water cooling system is currently in use so that discharge water is cooled to a temperature necessary to maintain Maggie Creek above its confluence with the Humboldt River within

2°C (35.6°F) of ambient river temperatures as required by the discharge permit. The addition of mine water to lower Maggie Creek would reduce seasonal erosion caused by ice and freeze-thaw conditions (BLM, 1993).

Impacts on Surface Water Quality

Groundwater at the South Operations area that is currently discharged to Maggie Creek has been pumped from the limestone aquifer (wells GQDW-10, GQDW-11, GQDW-12, GQDW-13, GQDW-14, GQDW-15, and MC-2). No treatment of this water is necessary, since the combined discharged water does not exceed the water quality standards established by the NPDES permit. Water pumped in the future would most likely exhibit similar characteristics. No water quality impacts are expected from discharge of excess mine water to Maggie Creek and the Humboldt River.
If the quality of the pumped water should unexpectedly deteriorate, a previously installed, but little used, water treatment facility to treat groundwater can be returned to operation. Water from this facility would meet all water quality standards established by the NDEP.

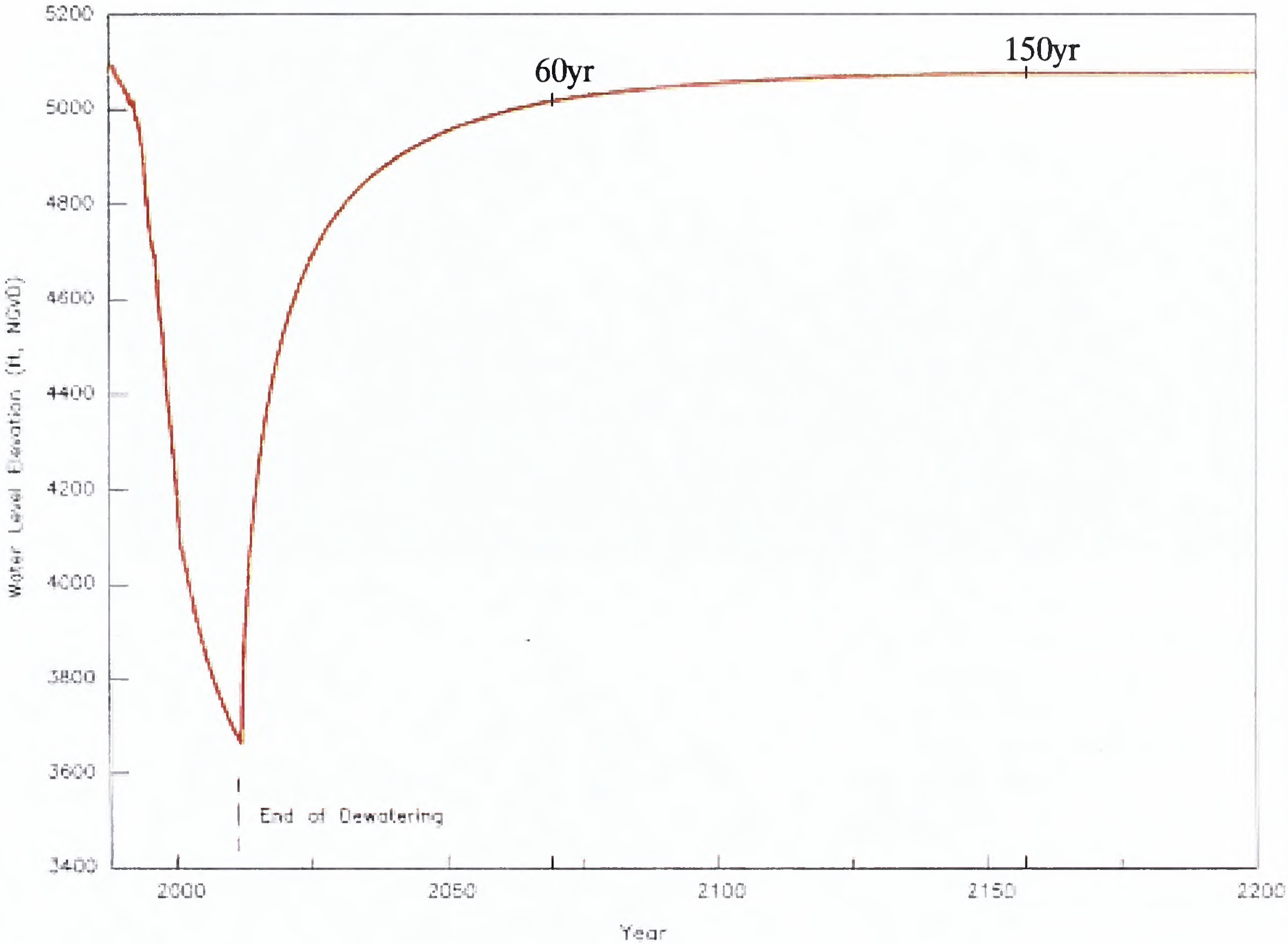
Impacts from Mine Pit Water Recovery

At completion of dewatering, a mine pit lake would begin to form as groundwater flows into the pit (**Figure 4-15**). The groundwater model predicts recovery of the pit lake ultimately to less than 8 feet below pre-mining water levels (HCI, 1999) (**Figure 4-16**). The lake would be approximately 1,370 feet deep and cover an area of approximately 400 acres. Under the previous analysis (BLM, 1993) the pit lake was estimated to have an ultimate depth of approximately 775 feet and cover an area of approximately 190 acres.

The pit lake surface would be approximately 300 feet below the eastern mine pit rim. Net evaporation from the final Gold Quarry pit lake would be an estimated maximum of 1,117 acre-feet per year (690 gpm or 1.5 cfs) based on a net evaporation rate of 33.5 inches per year. Net evaporation rate is calculated by subtracting precipitation (9.5 inches per year) from evaporation (43 inches per year) (Geomega, 1997a).

In order to evaluate chemistry of the pit lake, Newmont commissioned a study that utilized existing chemical and hydrogeologic data in conjunction with field studies, laboratory tests and computer models (Geomega, 1997b). The ultimate pit surface was characterized using a geologic block model. Six different units in the pit surface were defined; alluvium, carbonaceous siliceous refractory rock, sulfidic siliceous refractory rock, oxidized siliceous rock, oxidized carbonaceous rock, and unoxidized carbonaceous rock (**Figure 4-17**). Only the carbonaceous siliceous rock and the sulfidic siliceous refractory rock have predominantly negative net carbonate values, i.e., are potentially acid producing rocks. The acid producing potential of the carbonaceous siliceous rock is very small, however, it is very reactive and releases a greater mass of solutes into solution than the other units. For modeling purposes, the units were divided according to their net carbonate values and reactivity.

Humidity cell tests and field tests were conducted (Geomega, 1997b). The field tests were conducted in cells open to ambient precipitation and evaporation at the site. The field oxidation tests generated lower solute concentrations than the humidity cell tests. Chemical release functions were created from the humidity cell and the field tests. Chemical release functions show the concentration of a

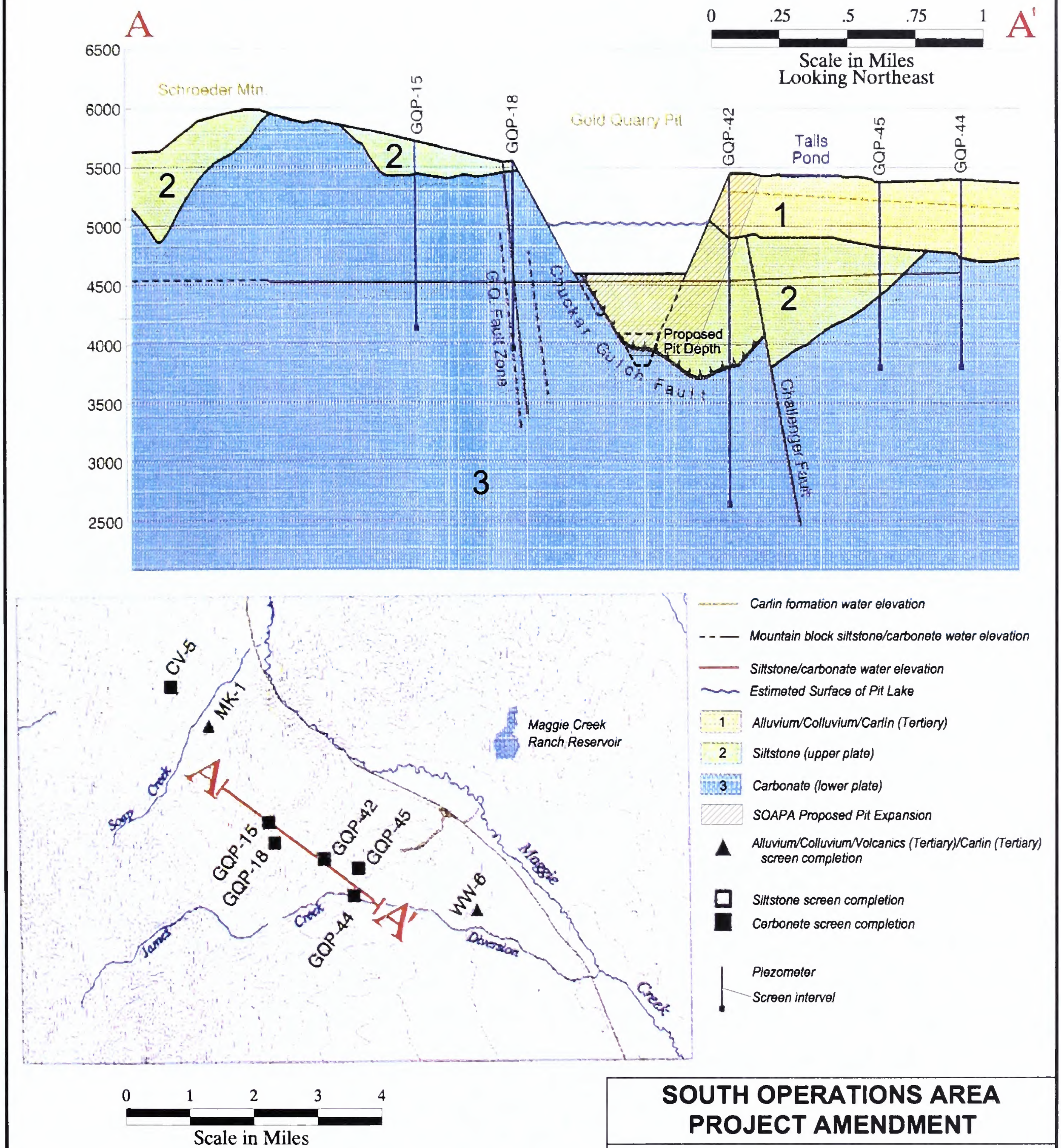


Source: HCI, 1998.

SOUTH OPERATIONS AREA PROJECT ADMENDMENT

FIGURE 4-15
PREDICTED WATER LEVELS IN GOLD QUARRY PIT

DATE: 6/6/00	ACAD FILE: Fig4-15.DWG
SCALE: NTS	DRAWN BY: ML, MODIFIED BY DS

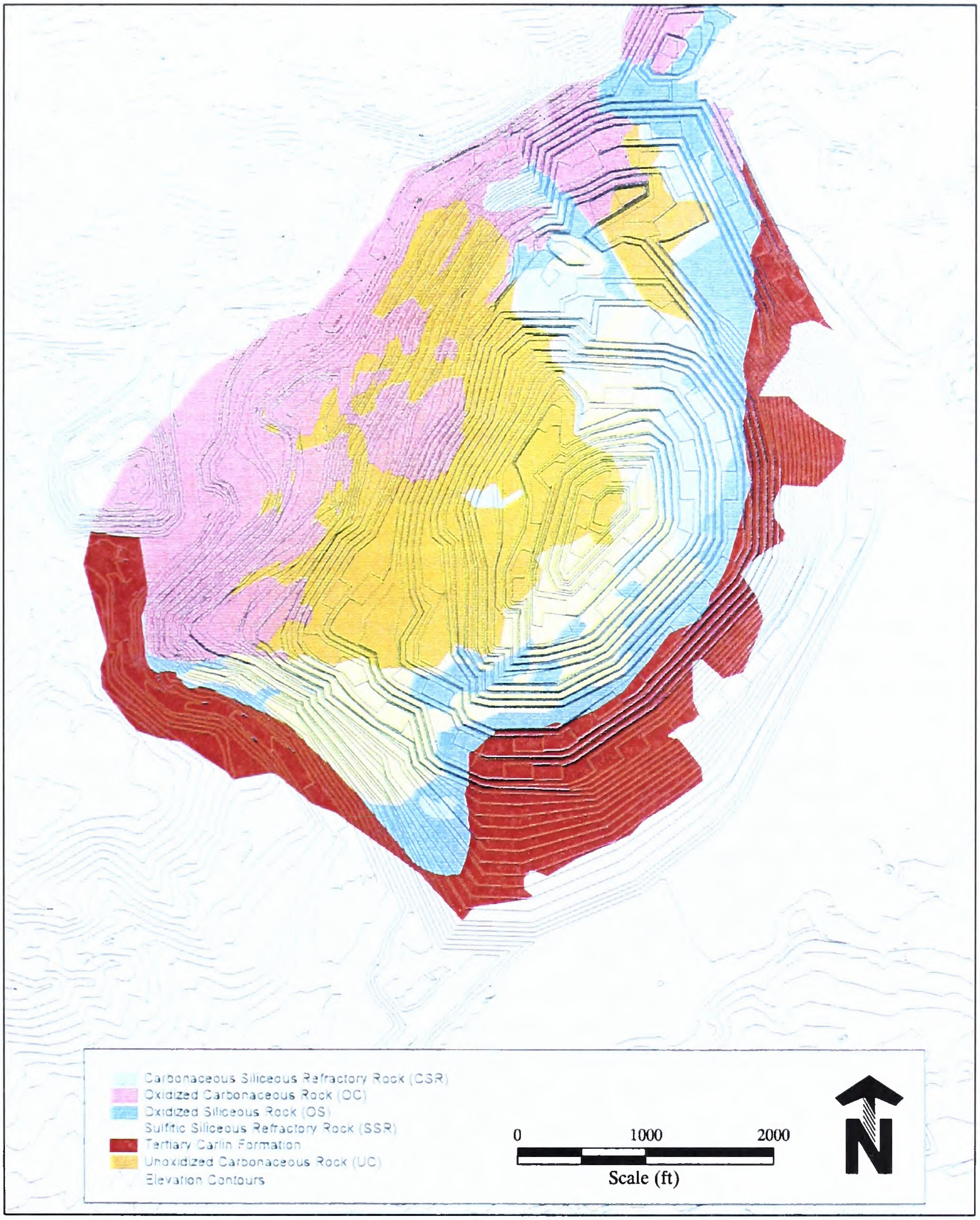


SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-16
SCHEMATIC HYDROLOGIC CROSS SECTION THROUGH PIT
(September 30,1997)

MINE AREA: SOUTH AREA	
DATE: 8/1/00	ACAD FILE: Fig4-16.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY EG

Source: Newmont, 1999c.



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-17
ULTIMATE GOLD QUARRY PIT SURFACE LITHOLOGY

DATE: 6/6/00	ACAD FILE: Fig4-17.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY DS

Source: Geomega, 1997b.

particular parameter in the leachate depending on time and on the net carbonate value of the leached rock. Both sets of data were used in the modeling. The oxidation of pyrite in the pit wall was estimated using the Fennemore-Neller-Davis model. Oxidation of pyrite leads to the generation of acid, and thus is an important factor in determining the pit lake chemistry.

The bulk pit lake chemistry was determined using the chemical release functions and the pyrite oxidation modeling results combined with the water inflow rates from the groundwater model. The bulk chemistry changes with time as the amount of leachate in the inflowing groundwater changes, and as solutes precipitate. The model PHREEQC (Parkhurst, 1995) was used to model the equilibrium chemistry of the pit lake, modeling geochemical reactions like sorption and precipitation. To assess the oxygen profile in the lake the model CE-QUAL-W2 (Cole and Buchak, 1995) was used.

The water of the Gold Quarry pit lake is predicted to be slightly alkaline, containing levels of constituents which do not exceed drinking water or aquatic life water quality standards, with the possible exceptions of antimony, manganese, mercury and selenium, (Geomega, 1997b). During the first years of pit refilling, 75 percent of the inflowing groundwater passes through the limestone in the base of the pit. Thus, the initial pit water has a large buffering capacity and neutralizes acidic inflows from the siltstone. Then alkalinity is predicted to increase over time until it exceeds the aquatic life standard in the mature lake (250 years) (Geomega, 1997b).

Constituent concentrations are at a maximum during the first years of pit refilling, when oxidation products are flushed out of the pit wall. These concentrations diminish with time, due to chemical reactions with recharging groundwater and removal by sorption and coprecipitation to amorphous ferric hydroxide.

Dissolved oxygen was predicted to range from approximately 7.5 to 11 mg/L. This result is primarily due to low biological and chemical oxygen demand in the pit lake. The water would undergo complete mixing in fall and in spring. Antimony is predicted to exceed only the drinking water standard in the mature lake (250 years). Predicted concentrations of manganese (0.191 mg/L) exceed the secondary drinking water standard (0.05 mg/L), in the mature lake, but not the juvenile lake (Geomega, 1997b). Predicted selenium concentrations (0.008 mg/L) exceed the 96 hour average aquatic life standard (0.005 mg/L) in both the juvenile and mature pit lakes, however, they do not exceed drinking water standards (Geomega, 1997b). Predicted concentrations of mercury (0.000286 mg/L) exceed the 96 hour average aquatic life standard (0.000012 mg/L) in both the juvenile and mature pit lakes, but never the drinking water standard. However, mercury would exist primarily in the inorganic form which is less toxic to aquatic organisms than organic methyl-mercury (Geomega, 1997b). Measurements of methylated mercury and inorganic mercury in three Nevada pit lakes (Anaconda, Aurora, and Boss pits) show that methyl-mercury is typically below detection levels (Geomega, 1997b).

The predicted final Gold Quarry pit lake composition and surrounding groundwater generally would be similar to or lower in dissolved metal concentrations than the pre-mining ore-zone groundwater (**Table 4-4**). The pit lake chemistry is similar to the pit lake chemistry previously analyzed (BLM, 1993)

TABLE 4-4
COMPARISON OF GROUNDWATER AND PIT LAKE WATER QUALITY[1]

Parameter	Existing Gold Quarry Groundwater[2]	Quality of Two Existing Pit Lakes		Predicted Quality of Gold Quarry Pit Lake[5]		Drinking Water Standards[6] (primary standards)
		Kimbley Pit[3]	Yerington Pit[4]	Gold Quarry Pit Lake	Predicted Range in 1993 EIS	
Aluminum	<0.10	NR	NR	0.026	0.017-0.037	-
Antimony	0.003	NR	NR	0.00806	NR	0.006
Arsenic	0.099	<0.180	0.014	0.025	0.028-0.043	0.05
Barium	0.090	0.009	0.034	0.014	0.032-0.033	2.0
Cadmium	<0.005	<0.007	0.008	0.001	<0.001	0.005
Chloride	17.0	264	40	117	8.7-8.8	400.0 (S)
Chromium	<0.002	<0.010	0.02	0.005	0.006-0.025	0.1
Copper	<0.005	0.172	0.232	0.004	0.001-0.003	1.3
Fluoride	0.64	2.61	1.4	0.637	NR	4.0, 2.0 (S)
Iron	0.12	0.455	0.581	<0.001	<0.001-0.001	0.3, 0.6 (S)
Lead	<0.002	<0.050	0.012	<0.001	<0.001	0.015
Magnesium	16.6	NR	22.3	29.3	23.3-23.4	125/150 (mun/dom)
Manganese	0.013	0.31	0.076	0.194	0.13-0.15	0.05, 0.01 (S)
Mercury	0.0004	0.838	<0.001	<0.001	0.002-0.003	0.002
Molybdenum	0.1	NR	NR	0.114	NR	-
Nickel	0.01	NR	NR	0.075	NR	0.1
Potassium	7.8	NR	6.9	15.5	4.86-4.91	-
Selenium	0.059	<0.130	<0.002	0.008	0.006-0.011	0.05
Silver	<0.005	<0.020	<0.010	0.007	0.005-0.006	0.05
Sodium	90.0	NR	74	34.9	7.6-7.8	-
Sulfate	63	1,607	242	156	69-99	250,500 (S)
Thallium	0.010	NR	NR	0.001	0.025-0.028	0.002
Vanadium	0.1	NR	NR	0.00185	NR	-
Zinc	0.018	2.43	0.081	0.038	0.011-0.049	5.0 (S)
pH (SU)	7.3	7.59	8.21	7.8	7.96-8.31	6.5 - 8.5 (S)
Alkalinity	224	NR	110	290	24-52	

Source: PTI, 1992; Geomega, 1997b, NAC 445.117.

1 Concentrations are reported in milligrams per liter (mg/L), except pH which is in standard pH units (SU); NR = results not reported.

2 Well GQTW-4, screened in the Gold Quarry siltstone ore zone. Sample collected 7-15-91.

3 Kimbley Pit Lake, Ruth, Nevada. Sampled 9-24-91 (MacDonald, 1992).

4 Yerington Pit Lake, Yerington, Nevada. Sampled 10-29-90 (MacDonald, 1992).

5 Predicted Gold Quarry pit lake chemistry at equilibrium.

6 All concentrations reported are primary drinking water standards unless followed by (S) indicating secondary standards, or (mun/dom) indicating municipal and domestic standards.

with certain exceptions: barium, mercury and chloride would be lower; and manganese, potassium, and zinc would be higher. Alkalinity would also be higher.

Surface Erosion and Sedimentation

Erosion would occur in areas of increased surface disturbance at the South Operations Area Project Amendment. Sediment from these areas could accumulate in drainage ways and possibly in streams. Erosion is most likely to occur during heavy precipitation and runoff. Most drainage ways and streams in the mine area are ephemeral or intermittent and therefore would not carry increased sediment on a continuous basis. Impacts associated with accelerated erosion at the mine site are not likely to be major (see Chapter 4, Soils, for additional information on erosion and soil loss). Newmont has developed a monitoring program and best

management practices associated with EPA's stormwater regulations (codified at 40 CFR 122.26). The additional disturbance under the proposed action as compared to the currently approved action would not change the impacts due to erosion significantly.

Mine Processing Impacts

Other impacts on water resources could occur in the South Operations area as a result of: spills of lubricants, fuels, solvents, and cyanide onto the ground surface and into drainage ways; and seepage of cyanide into the subsurface from the leach pads and tailing impoundment. Impacts from direct mining activities would continue for a longer time under the Proposed Action than under the prior approval (BLM, 1993). Seepage of cyanide would pose a somewhat increased threat due to the larger volumes of leach ore and tailing.

The tailing impoundment is designed to contain a 100-year/24-hour storm. Failure of the tailing embankment would be highly unlikely based on design, operation, and monitoring. Storage of storm water in the tailing impoundment and potential failure of the tailing embankment was analyzed in the Mill 2/5 Tailing Storage Facility Environmental Assessment (BLM, 1991).

The existing Non-Property Leach Pad would be extended and Property Leach Pad 2 would be constructed. The Refractory Leach and bio-leach Facilities would also be expanded. Solutions containing cyanide and metals that are discharged to or utilized at the tailing impoundment and leach pads would be contained in the multiple-lined facilities, would be neutralized, and reclaimed. Releases during mine operation would be detected by monitoring wells and subsequently corrected. Waste rock and natural soils can attenuate some heavy metals and cyanide (BLM, 1991).

Cyanide Fate

Cyanide process solutions are in use throughout the gold recovery process. These solutions are present in the tanks and piping associated with the mill, lined ponds associated with the heap leach facilities, and in the heap leach and tailing disposal facilities. Newmont's reclamation plan includes provisions to neutralize and detoxify all cyanide solutions. All rinsate, residual liquor, and rain/snowmelt would be collected from the spent oxide heaps following completion of detoxification and neutralization procedures for disposal through evaporation. At this point in time, all solutions should be at or below the water quality criteria so that all process ponds, all transfer ditches/canals, and the tailing impoundment would serve as evaporation ponds. These activities would occur in accordance with NDEP regulations.

Cyanide is a highly reactive and relatively unstable compound. Its toxicity is directly related to the amount of cyanide ion (CN^-) and hydrogen cyanide (HCN) present in the solution. Neutralization and detoxification occur through chemical processes that volatilize hydrogen cyanide, bind the cyanide ion in stable nontoxic compounds, or otherwise degrade the cyanide into nontoxic constituents. Chemical agents such as chlorine, hypochlorite, or others may be used to accelerate these processes, but the proposed method consists of adding water to reduce pH and allowing exposure to air and sunlight to accelerate the degradation processes.

Reducing pH of the cyanide-bearing solution is the primary method of neutralization and detoxification. Cyanide remains in solution only under alkaline conditions (pH greater

than 9). As the pH is reduced through introduction of fresh water, the cyanide is converted to hydrogen cyanide gas and slowly released to the atmosphere.

Cyanide neutralization and detoxification at the tailing storage facility and leach pads would begin as soon as the facilities are removed from service. Residual water in the tailing storage facility would evaporate or seep through the tailing material to the underdrain system. Seepage would be collected in the seepage collection pond and treated to meet State of Nevada standards (0.2 mg/L weak acid dissociable cyanide and a pH between 6 and 9 standard units). In the arid environment of the mine site, it is expected that continuous seepage of residual tailing solution would cease approximately seven years after tailing deposition is halted. It is estimated that approximately 15 gpm (0.03 cfs) seepage from infiltrating precipitation may continue to discharge from the underdrain system of the tailing impoundment (BLM, 1993). This water may contain minor amounts of cyanide, but concentrations would be lower than the regulatory limit. Cyanide at these concentrations would not be expected to impact the environment and any residual cyanide concentrations would continue to decline over time through exposure to air and sunlight.

Cyanide solution in the leach pads would be neutralized and detoxified by recirculation and evaporation. Fresh water would be introduced onto the leach pads to rinse residual cyanide from the spent ore. The rinse water would be recycled through the leach pad until it meets the regulatory criterion described above. At that time, all rinse water would be collected and disposed through evaporation. If freshwater rinsing does not meet State of Nevada standards, additional neutralization techniques would be utilized. These actions are the same as analyzed in the original EIS (BLM, 1993).

Ammonium Thiosulfate Fate

Newmont would expand the Refractory Leach Facility to provide an ammonium thiosulfate leach pad for heap leaching the carbonaceous refractory ore in lifts without removing it from the pad. At closure, the ammonium thiosulfate leach facility would be drained down, and rinsed, and all remaining solutions disposed of by evaporation. The basic approach is to apply rinse water until the ammonium thiosulfate breaks down to benign levels. The ammonium thiosulfate will break down into ammonia gas and various recombined sulfates (salts). Continued rinsing will reduce the sulfates. If rinsing does not meet the State of Nevada standards for final seepage solutions, additional neutralization techniques would be investigated, in consultation with the BLM.

Alternatives

Potential impacts from either of the two action alternatives would be very similar to those of the Proposed Action, but with small specific differences. There would be no differences in impacts from the dewatering system. The potential drawdown would be the same for both action alternatives, so the potential effects on springs/seeps, wells, surface stream flows, water temperatures, and water quality would be expected to be the same. If 2 percent of the waste rock was placed in the Mac pit, there might be a proportionate reduction in surface erosion from waste rock disposal facilities.

No Action Alternative

The No Action Alternative would result in those impacts on water resources that have

been stated in the original EIS (BLM, 1993). The same kinds of effects were identified in 1993 as were discussed in this document. No further impacts would occur following cessation of mining in 2001.

Dewatering effects were predicted to occur in a drawdown area of 151,600 acres in 1993, compared to a predicted drawdown area for SOAPA of 177,700 acres. Dewatering effects would cease in 2001 under No Action and 2011 under the Proposed Action.

Potential Mitigation and Monitoring

The monitoring program for SOAPA will be based on a revised mitigation and monitoring plan. The revised plan is currently being formulated between the BLM and Newmont based on newly predicted potential impacted areas. BLM and Newmont will jointly decide upon the need for and location of any additional monitoring wells, spring and seep sites, and surface water stations. A revised Mitigation and Monitoring Plan is currently being developed and will be included in the Final EIS and Record of Decision. Mitigation measures would likely be the same as specified in the 1993 plan (BLM, 1993) including:

Groundwater Sources

- Replacement wells or other water source of equivalent yield and quality.
- Subordinate any baseflow losses with Newmont's senior irrigation water rights, if necessary.
- Any groundwater quality problems would be evaluated for potential source and remedied using best available technologies.

Springs and Seeps

- Replace lost flows or substitute water sources at nearby locations with wells, guzzlers, or other measures.
- Any spring or seep quality problems would be evaluated for potential source and remedied using best available technologies.

Streams and Rivers

- Newmont would augment any flow reductions in Maggie, Mary's or Susie creeks or their tributaries using the mine dewatering system, impounded runoff water, senior irrigation water rights or from new wells.
- Any surface water quality problems would be evaluated for potential source and remedied using best available technologies.

Stream Channel Stability

- Seasonal maintenance of the current channel stabilization program.

Irreversible and Irretrievable Commitment of Resources

During the life of the South Operations Area Project, approximately 600,000 acre-feet of groundwater would be removed cumulatively by the dewatering system, which is approximately 100,000 acre feet more than under the currently approved operations. A portion of this water would be consumed at the mine site and the remaining water would be discharged into Maggie Creek. Therefore, most of the water would be removed from the Maggie Creek Basin but would be retained in the Humboldt River Basin with the ultimate destination being the Humboldt and Carson sinks. Dewatering would expand the cone of depression and reduce or result in the loss of some stream and spring/seep flows in the

vicinity of the mine. The likelihood of impacts on springs or seeps is related to proximity to the mine. The groundwater removed and transported to the Humboldt and Carson sinks is irretrievable. The groundwater drawdown is essentially a reversible effect in the Maggie Creek Basin region.

Residual Effects

Successful implementation of mitigation measures would eliminate most residual effects on water resources. Continued dewatering discharges until 2011 may increase the total load of metals and trace elements to the Humboldt River, and ultimately to the Humboldt Wildlife Management Area, even though all discharges comply with water quality standards. The Gold Quarry pit would continue to be a source of groundwater loss through net evaporation at a maximum rate of approximately 1,117 acre-feet per year (690 gpm). Long-term quality of water in the Gold Quarry pit lake and surrounding groundwater is predicted to be similar to or better than existing groundwater quality. Some produced water would infiltrate from the Maggie Creek Ranch Reservoir, and some would be used for irrigation at the Hadley fields. Drawdown of groundwater and reductions in stream and river baseflows would slow and begin to approach pre-mining conditions in most streams after dewatering ceases. Although this period of recovery could extend up to 100 years, most recovery would occur within about 20 years after cessation of dewatering. Modeling of cumulative impacts from pit lake in the area predicts that baseflow of the Humboldt River may be permanently lowered by 1 cfs. Successful mitigation of springs and streams generally is unproven technology; should mitigation fail, residual effects would result.

FLOODPLAINS

Direct and Indirect Impacts

Proposed Action

Between Palisade and Rye Patch Reservoir, the Humboldt River has an average annual loss, so the addition of mine discharge water to the Humboldt River would temporarily help offset the natural reduction in baseflow downstream of Palisade. **Figure 4-13** is a representative cross-section showing mine discharge water plotted with baseflow and bankfull flow in the Humboldt River immediately downstream from the Maggie Creek confluence. The figure also indicates the flood prone level in the river. The flow increase from mine discharge in the Humboldt River would be well within the active channel for low and moderate flows, and would be undetectable during high flows. It is, therefore, also expected that mine discharge-induced flow increases would have an undetectable effect on the Humboldt River floodplain.

Alternatives

The effects on Humboldt River floodplains from either of the alternatives would be the same as for the Proposed Action.

No Action Alternative

There would be no impacts on Humboldt River floodplains different than those already occurring if the No Action Alternative were implemented. The magnitude of impacts would be slightly different in that mining discharge flows would be lower than those analyzed in 1993, but baseflow reductions during the post-mining period could be greater.

Potential Mitigation and Monitoring

No mitigation or monitoring of floodplains is proposed.

Irreversible and Irretrievable Commitment of Resources

There would be no irreversible or irretrievable effects on floodplains if the Proposed Action or alternatives were implemented.

Residual Effects

No residual effects are expected on Humboldt River floodplains.

SOILS

Impacts on soil resources are directly related to acreage of disturbance. All alternatives would have a similar impact on soils as the Proposed Action. Comparison of impacts for the Proposed Action and alternatives was conducted using the same mitigation and reclamation procedures for all actions.

Direct and Indirect Impacts

Proposed Action

Primary impacts on soil resources would include soil loss and reduction in productivity as a result of soil salvage, stockpiling, and redistribution during reclamation.

Impacts to soil resources were analyzed in detail by the BLM (1993). For the most part, impacts would be the same within the areas of new disturbance for SOAPA. Following is an evaluation of soils impacts specific to areas of new disturbance which differ from impacts analyzed in 1993.

In order to determine if a sufficient quantity of topsoil and useful subsoil would be available for reclamation, acreages of each soil type identified within the new disturbance areas were calculated **(Table 4-5)**. The average estimated depth of salvageable soil for each soil mapping unit within each of the five areas was then used to calculate the soil available for respreading. As shown in **Table 4-5**, the available volumes for each area are more than adequate to respread stockpiled soil to the 6-inch depth proposed in the reclamation plan.

Water erosion potential and resulting soil loss were quantified for areas of new disturbance using the Revised Universal Soil Loss Equation (RUSLE) (Renard et al., 1997) **(Table 4-6)**. Annual soil loss in tons per acre per year was calculated for each of the five areas of new disturbance associated with SOAPA. Soil loss was computed under two scenarios. The first (listed in **Table 4-6** as "nonvegetated") assumes highly disturbed soil conditions with little or no vegetative cover.

The second (listed in **Table 4-6** as "vegetated") assumes that reclamation is nearing completion with vegetative cover at expected density (Westech, 1992). **Table 4-6** indicates that soil losses due to water erosion are predicted to range between 10.4 and 20.3 tons/acre/year under the nonvegetated scenario.

TABLE 4-5
DISTURBANCE ACREAGE, DEPTH OF AVAILABLE SOIL, AND TOTAL AVAILABLE SOIL VOLUME

Soil Mapping Unit	Mapping Unit Symbol	Acres	Soil Salvage Depth (inches)	Soil available for respreading (yds^3)	Soil needed for respreading (yds^3)
Northwest end of Gold Quarry North WRDF and adjacent diversion:					
Bucan, 15-30% slopes	BU	124.03	18	300,153	
Malpais-Rock Outcrop, 50-75% slopes	MR	36.44	0	0	
Total for area		160.47		300,153	129,446
Southwestern portion of James Creek WRDF:					
Puett, 15-30% slopes	PT	6.20	12	10,003	
Susie Creek, 4-15% slopes	SC	67.37	18	163,035	
Total for area		73.57		173,038	59,346
Southwestern portion of Gold Quarry South WRDF and adjacent diversion:					
Cherry Spring, 2-8% slopes	CS	3.91	24	12,616	
Orovada, 4-15% slopes	OR	9.99	18	24,176	
Pie Creek, 15-30% slopes	PK	155.50	6	125,437	
Puett, 15-30% slopes	PT	63.98	12	103,221	
Total for area		233.38		265,450	188,260
Ancillary Leach and adjacent portion of refractory ore stockpile					
Berning, 30-75% slopes	BE	6.16	0	0	
Cherry Spring, 2-8% slopes	CS	86.68	24	279,720	
Puett, 15-30% slopes	PT	18.99	12	30,637	
Total for area		111.84		310,357	90,218
Property Leach Pad 2 and southern portions of Refractory Leach Facility Expansion and Non-Property Leach Pad Expansion					
Cherry Spring, 2-8% slopes	CS	628.17	24	2,026,895	
Orovada, 4-15% slopes	OR	50.10	18	121,242	
Puett, 15-30% slopes	PT	77.59	12	125,179	
Total for area		755.86		2,273,316	609,727

TABLE 4-6
SOIL LOSS TO WATER EROSION BY DISTURBANCE AREA

		Leach Pads & Waste Rock Piles		Soil Stockpiles	
		Non-vegetated	Vegetated	Non-vegetated	Vegetated
Percent slope		43	43	40	40
Maximum slope length (ft.)		116	116	130	130
Slope length & steepness factor		7.8	9.0	7.6	8.9
Cover factor		.45	.013	.45	.013
Northwest end of Gold Quarry North WRDF & adjacent diversion	k factor	.30	.30	.30	.30
	soil loss/tons/ac/year	12.2	.30	12.0	.30
Southwestern portion of James Creek WRDF	k factor	.26	.26	.26	.26
	soil loss/tons/ac/year	10.5	.26	10.4	.26
Southwest portion of Gold Quarry South WRDF & adjacent diversion	k factor	.35	.35	.35	.35
	soil loss/tons/ac/year	14.2	.35	14.0	.35
Ancillary Leach & adjacent portion of refractory ore stockpile	k factor	.50	.50	.50	.50
	soil loss/tons/ac/year	20.3	.51	20.0	.49
Property Leach Pad 2 & southern portions leach facilities expansions	k factor	.50	.50	.50	.50
	soil loss/tons/ac/year	20.3	.51	20.0	.49

Such losses would exceed maximum tolerable limits during the period between soil redistribution and successful reclamation. According to the USDA (1983), the maximum tolerable soil loss varies between one and 5 tons/acre/year depending on depth of the soil to unfavorable substrata. However, once revegetation is reestablished, losses would be 0.51 tons/acre/year or less.

Alternatives

The action alternatives would have direct and indirect impacts similar to the Proposed Action. Any differences in impacts would be negligible because the alternatives would disturb an area of six and 53 acres less than the Proposed Action, respectively.

No Action Alternative

The No Action Alternative would not create any new disturbance from soils. Newmont would continue their current soil salvage and mitigation program as part of the approved Reclamation Plan. The No Action Alternative has, or would, disturb 7,960 acres, while the Proposed Action would disturb 1,392 additional acres.

Potential Mitigation and Monitoring

Newmont would continue to implement mitigation measures to control surface erosion and sedimentation as was described under mitigation for water resources. Newmont would further mitigate impacts to the soil resource by continued implementation of their reclamation plan, including enhanced reclamation techniques. Included in the plan are the creation and stabilization of topsoil stockpiles, the creation and monitoring of vegetation test plots, the spreading of topsoil after facility sites are closed, and the revegetation of the site.

Three of the five enhanced techniques would not be implemented until operations cease (landscape considerations, raptor habitat enhancement, and establishment of diversified ecosystems). Two of the enhanced reclamation techniques are being implemented on a concurrent basis (topsoil management plan and intensified test plot program). The topsoil management plan has proven effective in salvaging and protecting topsoil. The intensified test plot program is continuing to generate data that will be useful during final reclamation.

Irreversible and Irretrievable Commitment of Resources

The projected soil losses during operations are irretrievable and irreversible. Following revegetation, soil losses would be reduced to acceptable minimum levels or better.

Residual Effects

Physical and chemical disruption of soil by salvaging and stockpiling would constitute a loss of soil productivity. This loss is, however, largely reversible over time by natural soil development. Reclamation steps such as grading, spreading topsoil, and revegetation expedite this process, but soil rebuilding requires many years. If reclamation is not successful, these impacts would be extended in time.

VEGETATION

The Proposed Action would disturb an additional 1,392 acres of vegetation, primarily lower elevation sagebrush-bunchgrass community types in deteriorated range condition. (Disturbance has already occurred on 7,960 acres.) While reclamation would restore much of the disturbed area, some features (e.g., mine pit) could not be reclaimed. It is the intent of reclamation to restore a functional plant community that would include adequate cover and diversity to provide for post-mining land uses. Reclamation will, however, have to provide comparable plant cover to undisturbed reference areas in order to be judged acceptable by BLM. The process of future re-colonization could then increase the percentage of plant cover and plant diversity in the future.

Direct and Indirect Impacts

Proposed Action

The Proposed Action would have direct, indirect and cumulative impacts on the vegetation resources within the project area. Surface disturbances associated with expansion activities are anticipated to avoid wetland and riparian environments, and only impact upland vegetation. However, these wetter communities may be impacted by the changes to the hydrologic regime caused by pit dewatering. Any loss or reduction in water provided for grazing cattle could result in reduced stocking rates or shortened grazing periods. However, the magnitude of the impact, if any, is dependent on the location of impacted and non-impacted waters. This would avoid increased numbers of cattle being placed on reduced acreages that still have available water. This would avoid impacts on vegetation resources.

Direct impacts to upland vegetation would occur as a result of the construction of the proposed facilities and would continue during their operation. Specifically, the construction of the proposed facilities would eliminate 1,392 acres of native vegetation. Acres of disturbance by facility are provided in **Table 2-6**. This physical disturbance would remain during the life of the operation, and is considered short-term. Upon closure of the mine, vegetation coverage would be replaced at the SOAPA facilities by reclamation activities. By returning the vegetative cover to the landscape, reclamation would mitigate most impacts to the area caused by the proposed physical disturbance. Despite reclamation activities, vegetation resources within the proposed disturbance area would incur some long term impacts. It is not anticipated that the revegetation process would restore the species diversity or species composition of the preexisting plant community, and thus these two values would be permanently impacted. Natural restoration of these values could occur over extensive periods of time.

Indirect impacts to upland vegetation would also occur as a result of the Proposed Action. These impacts would arise from the direct impact of vegetation removal necessary for the construction and operation of the facilities, and would affect undisturbed as well as disturbed vegetation in several ways. First, vegetation removal would increase fugitive dust levels, which in turn would inhibit photosynthesis and transpiration processes. Second, the potential for erosional features would increase, hindering rooting success. Finally, the potential for weedy species to invade and become established would increase. This impact would likely be problematic indefinitely due to the nature of weed invasions (see section on Noxious Weeds, below).

Accidental spills of leaching agent and/or pregnant solution are not anticipated to impact vegetation resources for the following reasoning. Accidental spills could occur either in transport or on-site and would be immediately addressed by Newmont's Spill Prevention, Control, and Countermeasures plan. Onsite, accidental spills would not come into contact with vegetation, and clean up would insure that soil and water were decontaminated. Spills that occur during transport would be treated in a similar manner, decontaminating soils and water to ensure no future contamination. If vegetation was impacted or removed as a result, effects would be restored by revegetation.

Alternatives

The alternative of backfilling the Mac pit would result in approximately 40 more acres of revegetated area than the Proposed Action. By placing waste rock in the Mac pit, the waste rock disposal facilities would be slightly smaller. It is estimated the WRDFs would be six acres smaller. The alternative of modifying the WRDFs would provide approximately 53 acres less disturbance than the Proposed Action. This would be accomplished by building the WRDFs taller instead of broader.

No Action Alternative

The No Action Alternative would have no additional kinds of impacts on vegetation beyond those described under already approved, current operations. Disturbance would, or has, occurred on 7,960 acres while the Proposed Action would disturb an additional 1,392 acres.

Potential Mitigation and Monitoring

No additional mitigation is proposed beyond implementation of the approved Reclamation Plan of 1993, as amended in 1996, March 1997, and December 1997. Part of that plan includes the monitoring of test plots for revegetation success. The test plot program is designed to identify the optimum combination of topsoil depth, soil amendments, and plant species. The test plots have already proven effective in aiding concurrent reclamation. Off-site mitigation has been provided by Newmont for vegetation lost from the pit area for both existing operations and SOAPA (1,000 acres) by seeding areas at Bob's Flat and Dunphy Hills (6,566 acres).

Irreversible and Irretrievable Commitment of Resources

There would be an irreversible commitment of potential vegetative productivity in the loss of 139 acres taken by the Gold Quarry pit expansion. There would be an irretrievable loss of vegetative productivity on the areas where new facilities are constructed until reclamation is complete. Either of the action alternatives would also have similar irretrievable losses of vegetative productivity from facility sites, but the Mac pit backfill alternative would result in approximately 40 fewer acres of land irretrievably lost to any continued surface uses. The modified WRDF alternative would result in approximately 53 fewer acres to be irretrievably lost in comparison to the Proposed Action.

Residual Effects

Residual effects of the Proposed Action and alternatives would be determined by the success of reclamation. When reclamation success is achieved, there would be no residual effects on vegetation.

NOXIOUS WEEDS

Direct and Indirect Impacts

Proposed Action

This section provides a description of the potential for the establishment and spread of noxious weed communities within the project area and within the study area as an environmental consequence of the Proposed Action. Soil disturbance plays a significant role in opportunities for the establishment of noxious weeds. The proposed project would involve the disturbance of 1,392 acres of

vegetation through mining activities, removal of waste rock to disposal facilities, and the construction and use of ancillary facilities (including roads, yards and linear corridors). In addition, the dewatering process is expected to result in reduced or eliminated baseflow of springs in the area. This change in the hydrologic regime can be expected to affect the wetland plant species in and around the springs and open up habitat for weed establishment.

Noxious weeds are not equal in their potential for effects, therefore the weeds of concern should be addressed individually as to potential for effects and options for mitigation and/or control measures.

The three plants identified as dominating the weed infestations currently found on mine facility sites are particularly tenacious due to individual habits. For example, Scotch thistle seeds can be viable for over 30 years (BLM, 2000c), and so, though buried and unable to germinate for years, can, once uncovered, lead to a new infestation. Saltcedar likewise can propagate from buried or submerged stems. The salts which accumulate in the plant can leach from the plants and, if present in large quantities, can result in a saline soil. This soil can, in turn, impede the establishment of desirable vegetation.

The weed survey of 1998 (JBR, 1998) indicated weed infestations on approximately 101 acres at the South Operations area. The Proposed Action would reduce several of the infested sites by removing them or covering them. The expansion of the Gold Quarry North WRDF would eliminate approximately 43.5 acres of scotch thistle. The removal of the James Creek tailing facility would remove 0.34 acres of scotch thistle, some Canada thistle, and several hundred saltcedar plants. The expansion of the James Creek and Gold Quarry South WRDFs would eliminate approximately 1.1 acres of scotch thistle. The scotch thistle infestations in Section 18 would all be eliminated as well.

These removal effects would be countered to some unknown degree because all of the new areas disturbed for construction would present new sites for invasion (1,392 acres). It is reasonable to assume that some new sites of weed invasion would occur, but such invasions are difficult to predict in terms of species likely to establish and extent which could be expected. Newmont's weed control program would implement controls on any new infestations and reduce the potential for impacts by any new infestations.

Alternatives

The potential impacts from either of the Action Alternatives would be expected to be very similar to those described for the Proposed Action, as the alternatives would also expand the same facilities, disturb a similar amount of ground, construct similar ancillary facilities, and the volumes of materials moved would be the same as the Proposed Action.

No Action Alternative

If the No Action Alternative were implemented, there would be no new impacts resulting beyond those already in effect. The existing noxious weed community would not be expected to appreciably increase because of no new disturbance, and thus no new sites for invasion areas would be created. Newmont's current weed control efforts would be continued for the life of the mine and the reclamation period.

Potential Mitigation and Monitoring

Newmont conducts annual weed surveys, and these would be continued. Information from these surveys is used to direct weed control efforts. Monitoring and weed control would continue until reclamation was complete.

Irreversible and Irretrievable Commitment of Resources

Where weed infestations are significant, they represent an irretrievable commitment of range productivity. During mining operations, the infestations on the mining property are not preventing utilization of the range because cattle are not allowed to graze on the property. If noxious weeds are not controlled during reclamation, then the loss of range productivity would occur after mining and reclamation is complete.

Residual Effects

The goal of noxious weed control is eradication. Some noxious weeds may remain on the site after mining and reclamation are completed. If there is a continued presence of noxious weeds after the mining operation is finished, it would represent a long-term reduction in range productivity.

RIPARIAN, WETLANDS, AND WATERS OF THE U.S. AREAS

Direct and Indirect Impacts

Proposed Action

The Proposed Action would have direct, indirect and cumulative impacts on the waters, wetland, and riparian resources within the incrementally expanded project area. No wetlands would be directly impacted by the placement of dredge or fill material in wetlands as defined and regulated by the U.S. Army Corps of Engineers. Instead, the sources of impacts would be due to the potential reduction of water resources, as described earlier in this chapter. Construction of facilities in Section 18 would impact 0.98 acres of Waters of the U.S. All alternatives would have impacts on wetlands and Waters of the U.S. similar to that of the Proposed Action.

The SOAPA is not anticipated to cause any different or greater impacts to the wetland and riparian resources from that previously estimated in the original EIS (BLM, 1993). It is anticipated that the Proposed Action would potentially impact riparian and wetland areas along Maggie, Marys, and lower Fish creeks. However, the modeled drawdown contour indicates that potential effects on riparian areas along Maggie Creek may be reduced, as the drawdown contour encompasses approximately four fewer miles of upper Maggie Creek than in 1993, as well as four fewer miles of Simon Creek and 4.5 fewer miles of Lynn Creek. The situation along Marys Creek is mixed, as the 1993 analysis indicated 8.5 miles of creek were within the drawdown contour and outside the spring domain. The 1999 modeling indicates that approximately 4.5 miles are no longer within the drawdown contour but that about one mile of lower Marys Creek above the confluence with the Humboldt river is now included in the 1999 drawdown contour. The end result for riparian areas along Marys Creek is that about three fewer miles of stream may be affected.

The drawdown contour also encompasses 5 spring and seep sites with about 2.5 acres of associated riparian habitat beyond those analyzed in 1993. All other springs and seeps encompassed by the expanded drawdown contour are located in mountain spring domains and thus are not predicted to be affected by mine dewatering. The kinds of impacts to wetland and riparian areas potentially caused by the dewatering activities are anticipated to be similar to those already documented in the 1993 EIS, e.g., vegetation composition could be modified from wetter species to drier area forbs, riparian acreage could be diminished, productivity could be reduced, and erosion could increase.

Wetland and non-wetland riparian zones associated with Humboldt River tributary streams would be affected by pit dewatering and discharge of excess water (**Figure 4-18**). Decreases or increases in baseflow (see Chapter 4, Water Resources) would modify streamside vegetation. A limited amount of riparian vegetation on tributaries to the Humboldt River would be potentially impacted by dewatering of the SOAPA project.

With reduction or loss of flows, species composition would be modified and acreage of riparian types diminished. Wetter site species would be replaced by species typical of the remnant riparian vegetation type. Site productivity would be decreased, resulting in lower value for livestock grazing and wildlife habitat. Streams potentially impacted include the following.

<u>Maggie Creek</u>. Riparian areas along Maggie Creek were fully analyzed in the South Operations Area Project EIS (BLM 1993). Some riparian wetland and non-wetland vegetation could be indirectly affected by the SOAPA. These areas occur along upper Maggie Creek from just above Maggie Creek Canyon to about East Cottonwood Creek. In that reach, the headwaters of a number of tributaries to Maggie Creek could potentially be dewatered. A qualitative assessment of potentially affected riparian areas can be seen on **Figure 4-18.**

With reduced flow, plant composition would be shifted toward species less dependent on water. Specific changes in wetland and riparian vegetation would depend on the magnitude and duration of flow reduction and the degree to which flows depend on unaffected water sources.

<u>Marys Creek</u>. Marys Creek supports riparian and wetland vegetation. The upper reaches are not expected to be impacted because baseflows are related to perched springs in the Marys Mountain spring domain. Wetland vegetation and riparian zones from the Carlin "Cold" Springs to the Humboldt River could, however, be impacted by predicted flow reductions at Carlin Springs. About one mile of stream has riparian and wetland vegetation in an area potentially impacted by the incremental expansion of the 10 foot drawdown contour.

<u>Simon Creek</u>. Simon Creek was analyzed in the South Operations Area Project EIS (BLM 1993). Hydrologic modeling in 1999 indicated that lower Simon Creek would be outside the 10-foot drawdown contour, while the headwaters would still be within the contour line. Given the uncertainty of hydrologic modeling and the uncertainty of effects on lower reaches of a stream when headwaters may be dewatered, indirect effects may still occur on the lower reaches of Simon Creek.

Fish Creek. Fish Creek supports a limited amount of riparian vegetation and would not be substantially affected by dewatering since it is primarily within the Independence Mountain spring domain.

Humboldt River. Potential effects on the Humboldt River riparian areas were disclosed in the South Operations Area Project EIS (BLM 1993). The same kinds of impacts would still be expected to occur, however, the analysis in 1993 was based on dewatering discharges of up to 42,000 gpm, but current analysis is based on less than 30,000 gpm. Therefore, potential impacts on riparian and wetland areas along the Humboldt are expected to be reduced below those disclosed in 1993.

Alternatives

Potential impacts to wetlands or riparian areas from either of the two action alternatives would be the same as those of the Proposed Action.

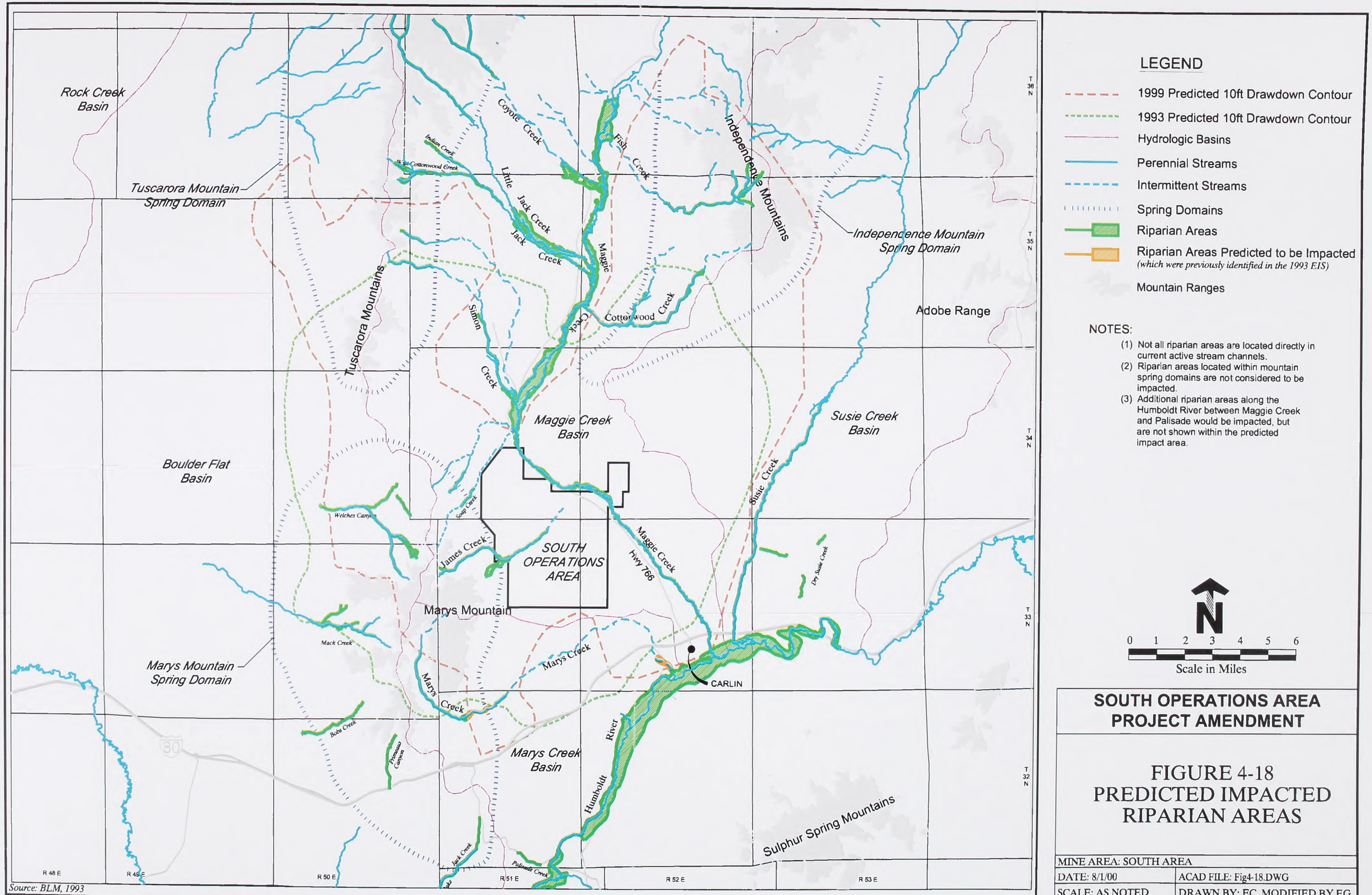
No Action Alternative

If No Action was selected, then potential impacts to five spring/seep wetlands would not occur, however, 25 spring/seep wetlands would be affected as approved under the existing South Operations Area Project. Streamflow would continue to be affected in Maggie and Marys creek basins and their tributaries, thus maintaining existing conditions for streamside wetlands. Additionally, under No Action, wetlands and riparian areas in lower Maggie Creek and along the Humboldt River would continue to experience augmented flows through 2001, and they would be exposed to lower base flows following the year 2001 as groundwater seeks to return the cone of depression to pre-mining levels.

Potential Mitigation and Monitoring

Continue implementation of the Maggie Creek Watershed Restoration Project. The project has been very effective in improving stream and riparian habitats within the Maggie Creek Basin. Additional information was provided in the Chapter 3 section on Riparian and Wetland Areas and Threatened, Endangered, Candidate and Sensitive Species. Also see **Appendix A** for a monitoring analysis of the Maggie Creek Watershed Restoration Project and "before" and "after" photographs of Maggie and Coyote creeks. However, some revision is needed for the Maggie Creek Watershed Restoration Project in terms of increasing flexibility in the grazing prescriptions and in refining biological standards. A few provisions of the Project including fencing on Susie Creek and a Conservation Easement will need to be completed.

New proposals for mitigation of riparian areas have not been made in light of the extensive monitoring and mitigation activities ongoing for streams and springs/seeps, which, if successfully implemented, should also serve to maintain riparian areas. However, if additional areas require monitoring or mitigation, then additional measures can be negotiated as part of the Mitigation and Monitoring Plan to be developed as part of the Record of Decision for this project. Potential sites identified by the BLM include the lower Jack Creek area and the hot springs wetlands (Spring #24).



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-18
PREDICTED IMPACTED RIPARIAN AREAS

MINE AREA: SOUTH AREA
DATE: 8/1/00 | ACAD FILE: Fig4-18.DWG
SCALE: AS NOTED | DRAWN BY: EC, MODIFIED BY EG

Irreversible and Irretrievable Commitment of Resources

Successful mitigation and eventual recovery of the hydrologic system would reverse wetland and riparian area degradation or loss. Losses would be irreversible only if the hydrologic conditions do not return to pre-mining conditions, or if the mitigation measures that Newmont has committed to (baseflow replacement or augmentation of springs, seeps, or stream reaches) prove inadequate. If certain wetlands or riparian areas cannot be mitigated, or do not recover, their loss would be irreversible.

Residual Effects

Wetlands and riparian areas associated with springs/seeps and streams that are predicted to be affected are expected to eventually return to near pre-mining conditions and not experience any residual impacts. If streams or springs are dewatered, their associated vegetative community could be altered toward a more upland community. As streams and springs recover, the vegetative community would be altered toward a more wetland community. While there is uncertainty that springs/seeps and streams would be affected, it is possible that some springs/seeps, if eliminated by dewatering, might not recover. Proposed mitigation measures (which could be conducted concurrently with mining) are expected to minimize adverse impacts and maintain conditions conducive to the recovery of wetlands and riparian areas.

TERRESTRIAL WILDLIFE

The primary impacts on terrestrial wildlife were discussed in the original EIS (BLM, 1993). Those potential impacts included direct loss of habitat (primarily sagebrush/grassland) and the loss or displacement of wildlife from affected habitat. Some of this loss would be pronghorn winter range and/or mule deer transitional range. Potential loss or reduction of some springs, seeps, and small streams due to groundwater drawdown would impact terrestrial wildlife dependent on these sites (e.g., amphibians, chukar, songbirds, waterbirds, small mammals, sage grouse, and predators) and may affect distribution of other species (e.g., bats, raptors, and mule deer) that use these sites as part of a larger habitat complex. Any loss or reduction in water provided for grazing cattle would result in reduced stocking rates or shortened grazing periods. This would avoid increased numbers of cattle being placed on reduced acreages that still have available water. This would avoid impacts to riparian areas.

Direct and Indirect Impacts

Proposed Action

The Proposed Action would result in direct loss of 1,392 acres of terrestrial wildlife habitat, including a limited amount of riparian habitat, until such habitat is reclaimed. One hundred thirty nine of these acres would not be reclaimed as they represent the incremental expansion of the Gold Quarry pit. Habitat losses would result from expansion of many existing facilities. Terrestrial wildlife is currently acclimated to these existing facilities and is rarely observed near any active facilities. New facilities would be constructed or expanded in sections 10 and 14, T33N, R51E, and Section 18, T33N, R52E. These are the primary areas where terrestrial wildlife might still be displaced. Wildlife use of the lands in R51E is primarily by mule deer as transitional range, and primary use of lands in R52E is by pronghorn as winter range.

The original EIS (BLM, 1993) fully discussed the potential impacts to terrestrial wildlife, and the expansion of facilities for SOAPA would continue those impacts in kind and magnitude. The following discussion represents a summary of potential incremental impacts expected from the expansion.

SOAPA would have direct effects on wildlife through accidental mortalities to wildlife that come in contact with lethal and sublethal solutions in the tailing facility and launders or transfer canals for process solutions. Historically, the South Operations Area Project has experienced approximately four bird mortalities per quarter and approximately one small mammal mortality per year. Newmont continues to seek means of reducing these mortalities, but a similar or lower frequency of mortalities is anticipated.

Upon cessation of dewatering of the Gold Quarry pit and recovery of the water table, a lake would form in the pit. This lake would be approximately 16 percent larger than the lake analyzed for the original EIS (BLM, 1993). The surface of the lake would be approximately 300 feet below the pre-mining surface of the pit. Birds, amphibians, reptiles, and large and small mammals could access the pit lake; however, lack of vegetation in the mine pit would limit significant use by wildlife, except perhaps by waterfowl as a resting area.

Since chukar, Hungarian partridge, and mourning dove are dependent on available water, the loss of this component of the habitat would limit the use of suitable habitat when free water is needed but is unavailable during the late spring to mid-fall period.

Some chukar upland habitat (steep-rocky slopes) would be lost, but this loss would be small compared with habitat available in the study area. The groundwater drawdown would potentially result in loss of free water and riparian habitat at several seeps near Simon Creek. Dewatering would also potentially impact available water in Lynn Creek and Simon Creek.

Expansion of the Gold Quarry South WRDF, Gold Quarry North WRDF, James Creek WRDF, and creek diversions would remove about 812 acres of historic mule deer transitional range. The existing SOAPA facilities already act to bisect this historic range, and act as a barrier to deer moving through this traditional transition range (**Figure 3-11**). Deer that used the historic range to access their winter and summer ranges, now utilize habitats west and north of the mine (Wilkinson, 1998). Because the proposed actions would occur on and immediately adjacent to the southern portion of the existing mine it is not anticipated that deer would be adversely impacted.

No known sage grouse display sites (leks) would be impacted by the Proposed Action. Under the proposed action, approximately 1,253 acres of year-round habitat would be lost for the life of the project, pending successful reclamation, and 139 acres of the same habitat would be permanently lost from the open pit expansion. The groundwater drawdown could impact up to 2.5 acres of riparian habitat at five springs and seeps and a limited amount of riparian habitat along streams. Approximately six acres of riparian habitat occur within the 10-foot drawdown contour but outside the spring domains and outside the 1993 drawdown contour (**Figure 4-18**). The remaining acreage occurs along other streams and the Humboldt River.

Raptors would also be affected by the loss of prey base as a result of disturbance of 1,392 acres of upland habitat. Because most raptors usually range over large areas, this loss is not quantifiable but is probably minor and would not result in a change in raptor diversity. Some raptors would be able to take advantage of prey availability in reclaimed habitats. In addition, most raptors in the area should be habituated to ongoing mining activities and new disturbances should not further impact these species.

Other groups of species such as small mammals and migratory birds may be affected by the proposed action. All facilities are fenced to prevent entry by large mammals, but small mammals and birds can gain access. Migratory birds could come in contact with tailing liquids along the beaches of the Tailing Disposal Facility. These liquids have a WAD cyanide content of less than 25 mg/L. This level is not lethal to birds, but a sub-lethal effect is postulated by researchers on birds that are stressed, such as during migration. Birds can also be exposed to metals and trace elements in the pit lake. However, of the metals with aquatic life standards, only molybdenum is predicted to exceed the 1-hr average standard. The pit lake is predicted to have a pH level of 7.8, well above the level that could pose acidic-water toxicity risks (pH levels less than 4.0). Biomagnification of metals and trace elements by aquatic organisms to levels potentially lethal to migratory birds could possibly develop over the long-term. Migratory birds may also be exposed to a total loading of metals and trace elements in the Humboldt River that is higher than premining conditions, even though all discharges are in compliance with water quality standards. If streams or any flat water areas were decreased by dewatering drawdown, some migratory birds might experience displacement and expend additional energy searching for suitable resting or foraging habitat. This could potentially compromise the survival of some birds, especially those stressed by migration.

Water from the dewatering system and/or storage reservoir would be discharged into Maggie Creek and eventually the Humbolt River. Discharge flows would vary, but would eventually peak at less than 30,000 gpm. This is more than 12,000 gpm than was identified in the original EIS (BLM, 1993). The original analysis indicated that some wildlife may have difficulty crossing Maggie Creek at higher flows. This has not proved to be the case. However, if flows are sufficient in the spring, antelope may have difficulty leaving their winter range to access transitional and summer ranges (Wilkinson, 1998). A similar situation would occur for mule deer attempting to move from crucial winter range east of Carlin to crucial winter range west of Carlin, although the magnitude of the impact would be less than for pronghorns. During high water periods in the spring, Newmont would store discharge water in the Maggie Creek Ranch Reservoir.

Alternatives

Backfilling of the Mac Pit

Impacts to the wildlife resource as a result of this alternative would be similar to those described for the Proposed Action. The only difference would be that the Mac pit would be backfilled with waste rock, thus providing an additional 40 acres of wildlife habitat. By placing the waste rock back into the Mac pit the size or height of both the Gold Quarry North and South WRDF's would be reduced by six acres. This alternative would result in additional wildlife habitat, both from smaller WRDF's and from the backfilled pit. All

other potential impacts would be the same as described under the proposed action alternative.

Modified Waste Rock Disposal Facilities

This alternative is essentially the same as the Proposed Action, expect for the handling of the waste rock. Under this alternative some waste rock would be hauled to various areas for road and embankment construction. In addition, the Gold Quarry South WRDF would be constructed higher and therefore minimize its footprint. This would result in 50 acres less potential wildlife habitat being lost within the footprint. This alternative would also result in three fewer acres of disturbance for construction of a water diversion around the South WRDF.

No Action Alternative

The No Action Alternative would have no additional impacts on wildlife other than those already projected at the South Operations Area Project. Dewatering effects and habitat disturbance would cease in 2001, rather than 2011 under the Proposed Action.

Potential Mitigation and Monitoring

Numerous mitigation or monitoring activities are currently being implemented by Newmont as part of their approved Mitigation Plan (BLM, 1993). These measures include:

- Reclaim most disturbed areas to a diverse, self-sustaining ecosystem. This mitigation measure is ongoing in the case of concurrent reclamation. Newmont has reclaimed some areas which, preliminarily, appear to be diverse and self-sustaining. Final reclamation would not occur until mining operations cease.
- Implement the Maggie Creek Watershed Restoration Project to improve wildlife habitat within the upland, riparian and wetland areas adjacent to Maggie, Simon, Jack, Little Jack, and Coyote creeks. This measure was described previously under water resources and has proved effective. There is some potential that dewatering drawdown may compromise this mitigation measure.
- Realign and redesign the North Area Haul Road to facilitate mule deer migration. This mitigation measure has proven successful in regard to preventing mule deer mortality.
- Conduct restoration on the Dunphy Hills Winter Range (Gold Quarry Mitigation Plan) and Tuscarora Transition Range (South Operations Area Project Mitigation Plan). This rehabilitation was initiated (on over 6,500 acres) in 1992 and completed in 1998. Observations on the effectiveness of the restoration are ongoing.
- According to Bob's Flat EFR and the Mule Deer Mitigation Reseeding Cooperative Agreement - Special Stipulation - Item O, and adjusted acres that were rehabilitated, Newmont could elect to apply acres that cannot be reclaimed (e.g. the 139-acre pit) to the acreage in the "mitigation bank." According to BLM calculations for mitigation, the following seedings were completed on public lands as mitigation for the effects of Newmont mining operations on mule deer habitat and, in effect, are in the "mitigation bank:" 1,538 acres on the aerial block, 949 acres on the

Geenstrip block, and 940 acres on the mid-elevation block, for a total of 3,427 acres. Four other Newmont projects required mitigation for 1,386 acres that are to be subtracted from the 3,427 acres. The 2,041 remaining acres can be applied to mitigate effects of past, present and future mining actions as stated in the Cooperative Agreement.

- The 2,041 acres in the "mitigation bank" can be applied as mitigation for mule deer habitat permanently lost to the pit expansion of 139 acres. In addition to following the format established in the SOAP Mitigation Plan (BLM, 1993), Newmont should consider fencing or resting the seeded area from livestock use for a minimum of three growing seasons on either public land or lands owned by Newmont, or a combination thereof. The BLM would consider a third-party arrangement to complete NEPA documentation and rehabilitation work through consultation with BLM, Newmont, and possibly NDOW. An agreement on grazing management on the seeded area over the long-term should be an item negotiated in the final Mitigation Plan to be developed as part of the Record of Decision for this project.

- The 139 acres of sage grouse habitat permanently lost to the pit expansion could be mitigated in other ways such as off-site habitat enhancement, creation of new water sources (guzzlers), additional protection for known leks, or other measures to be identified in the Final Mitigation Plan for the Record of Decision.

- A potential mitigation measure would be the establishment of a monitoring site at the pit lake. The site should include water quality including metals and trace minerals, development of aquatic organism communities, and wildlife use of the lake.

- Compliance with the Migratory Bird Treaty Act would be ensured through the use of mitigation measures. Such measures would include conducting land clearing outside the breeding season of migratory birds utilizing the site; conduct nest surveys prior to land clearing if inside the breeding season; and the use of buffer zones around identified nests during the breeding season.

Irreversible and Irretrievable Commitment of Resources

Wildlife resources are generally considered renewable. If wildlife habitats lost through implementation of the Proposed Action or alternatives are reclaimed to pre-mining condition after project completion, only open pit areas would be irreversibly and irretrievably lost to wildlife resources.

The degree of land surface recovery after mining ceases would depend on success of reclamation. It is highly unlikely that reclamation would create habitat similar in quality to pre-mining conditions. As a result of not having pre-mining quality habitat, it is probable that diversity and density of many species would not recover to pre-mining levels within the foreseeable future.

There is a possibility that small, isolated populations of some species of small mammals, reptiles, amphibians, or invertebrates associated with springs could be irretrievably lost if springs dry up. Repopulation through dispersal would likely

be slow or nonexistent if affected springs are isolated from unaffected wildlife populations by areas of unsuitable habitat or relatively large distances.

Residual Effects

Even though the Gold Quarry pit would be bermed or fenced, some mammals may possibly enter the steep-walled pit and drown. The juvenile pit lake (after five years) is expected to have a pH of 7.4 and 876 mg/L of total dissolved solids. After 250 years, the lake is expected to have a pH of 7.8 and TDS of 783 mg/L (Geomega, 1997b). Pit lake water quality is not expected to be injurious to wildlife such as birds and bats. It will also take some time for water quality in the pit lake to stabilize.

When lands disturbed by the expansion facilities are fully revegetated following reclamation, the habitat would be less diverse and have slightly less ground cover than prior to mining. This habitat would not support the same numbers or diversity of wildlife as existed prior to mining. Any unmitigated loss of springs/seeps or wetlands/riparian areas would reduce the diversity of small mammals, birds, and other organisms dependent on the wetted areas. If terrestrial wildlife are lost as a result of lost riparian areas that don not recover after dewatering ends, their loss would be a residual effect. If metals and trace elements are elevated or concentrated in the Humboldt River or in the pit lake with resultant deleterious effects on terrestrial, aquatic, or avian species, those effects would be residual over long time periods.

AQUATIC HABITAT AND FISHERIES

Potential impacts of the SOAPA on aquatic habitat and fish would be associated primarily with potential alteration of surface water baseflows and spring flow. These potential baseflow reductions would result from continuation of the dewatering program with resultant groundwater drawdown for a longer period than previously analyzed and over an incrementally larger area. Reduced surface water baseflows may eliminate or severely reduce numbers of fish and many aquatic invertebrates. Extension of the ongoing dewatering discharges would extend the period of reduced baseflows following the cessation of mining and thus have the most potential to affect the Humboldt River.

Direct and Indirect Impacts

Proposed Action

Dewatering Impacts

Potential impacts of the SOAPA on aquatic habitat and fish could result from potential alteration of surface water baseflows. Refer to the Water Resources Section for a detailed discussion of these predicted drawdown impacts. Because, for the purposes of this resource, the SOAPA is primarily an extension of the dewatering period, the impacts would be of the same kind as those presented in the original EIS (BLM, 1993), but would be expanded in area and in time.

The currently approved dewatering operation would end in 2001. The proposed SOAPA would extend the dewatering until 2011. This extension would result in a deeper drawdown of the water table (cone of depression) than would occur under the currently approved project. Accordingly, this could reduce more surface water baseflows and over a farther distance from the Gold Quarry pit, and lengthen the groundwater recovery period.

The incremental expansion of the predicted 10-foot groundwater drawdown contour line is used as the definition of the area of potential surface water impact. Groundwater drawdown would occur outside of the 10-foot drawdown line; however, these changes would be difficult to distinguish from seasonal or long-term natural variations. In most of the modeled area, the depth to groundwater is greater than 50 feet so that groundwater drawdown does not interact with surface water and would not impact surface water (Newmont, 1999b).

Potential drawdown impacts (see Water Resources) could diminish the amount and condition of aquatic habitat. This would affect the aquatic invertebrates and fish species that depend on those water sources by reducing or eliminating species from a particular aquatic habitat. Up to five spring and seep sites could be affected through reduced or complete loss of flows in the incremental area of groundwater drawdown.

Streams with portions of their length within the incremental 10-foot drawdown contour within the Maggie Creek subbasin include Lynn, Fish and Marys creeks. Actually, the revised groundwater model serves to remove approximately 4.5 miles of Maggie Creek from within the predicted 10-foot drawdown contour. The removed area of Maggie Creek is immediately above Maggie Creek Canyon. Additionally, baseflow in the Humboldt River between Carlin and Palisade is predicted to decrease by as much as 4.9 cfs (2,200 gpm) after dewatering ceases and to have a long-term reduction of about 1.5 cfs (673 gpm) (HCI, 1999).

Maggie Creek watershed restoration work conducted to mitigate for dewatering impacts predicted in the 1993 EIS would also mitigate the impacts predicted to occur from the extension of dewatering to year 2011. Grazing practices which favor riparian vegetation establishment have an important influence in reducing erosion resulting from discharge flows.

Discharge Impacts to Maggie Creek and Humboldt River

The SOAPA proposes to continue discharge of mine-water to lower Maggie Creek. The discharge is located approximately seven miles north of its confluence with the Humboldt River. This discharge potentially affects aquatic biota by increasing stream temperatures, increasing streamflows, and decreasing dissolved oxygen compared to natural conditions.

Increasing the stream flows to lower Maggie Creek would not accelerate bank erosion, increase sediment transport, nor increase lateral channel migration BLM, 1993. Newmont has constructed bank stabilization structures within the Maggie Creek channel which serve to mitigate these effects (see Chapter 4, Water Resources). Other water quality impacts expected from discharge of excess mine water to Maggie Creek and the Humboldt River include potentially higher loadings of metals and trace elements, which could result in effects on species in the

Humboldt River and the Humboldt Wildlife Management Area.

Alternatives

Both the action alternatives would have the same potential impacts to aquatic habitat and fisheries as those described for the Proposed Action, as the amount of dewatering would be the same.

No Action Alternative

The No Action alternative would result in those potential impacts on aquatic resources that have been analyzed in the original EIS (BLM, 1993). Under the No Action alternative, current mining operations, including dewatering activities, would continue until 2001. The same streams would have potential dewatering effects except upper Lynn and Fish creeks. Potential dewatering of Maggie Creek may be some what greater than under the Proposed Action because modeling in 1993 predicted more of Maggie Creek was in the drawdown contour.

Potential Mitigation and Monitoring

Impacts that were predicted to occur as a result of the existing Project were mitigated by Newmont implementation of the Mitigation Plan (BLM, 1993). Many items have been completed or are currently being implemented. A summary of items in the plan is as follows:

- The Maggie Creek Watershed Restoration Project is a program to achieve restoration and enhancement of upland, riparian and wetland habitat in the Maggie Creek subbasin through a cooperative effort among Newmont, the BLM, the TS Ranch, the Maggie Creek Ranch, and others. This will continue to enhance aquatic habitat in the subbasin. Results of this project were summarized in the mitigation section of Riparian, Wetland and Waters of the U.S. section earlier in this chapter.

- Mitigation of potential baseflow losses to creeks, including Maggie, Susie, James, Soap, and other area creeks through riparian improvement projects and, if necessary to protect riparian and aquatic values, through temporary stream baseflow augmentation in middle Maggie Creek, Susie Creek, and biologically important seeps and springs.

- Recolonization of depleted sections of the Humboldt River using indigenous invertebrates after monitoring determines the need. This mitigation measure has not yet been necessary.

- Prevention of increased sediment loading to the Humboldt River through implementation of channel stabilization measures and creation of a polishing wetland at the base of Maggie Creek. This has been accomplished and demonstrated to be effective.

- Prevention of temperature increases by construction of cooling towers. The towers have been constructed and demonstrated to be effective.

Recent field reconnaissance surveys and BLM monitoring reveal that these mitigation procedures are effective in providing mitigation for the existing project. Riparian and aquatic habitat in Maggie Creek and several tributaries have improved dramatically since initiation of the restoration efforts. Recommendations for mitigation of the

proposed amendment would be to continue with the current mitigation strategies. Additional mitigation recommended is presented in the Threatened and Endangered Species Section below.

Irreversible and Irretrievable Commitment of Resources

There is potential for irreversible or irretrievable commitment of aquatic resources resulting from the dewatering of springs/seeps or stream reaches. If springs or streams are dewatered, the aquatic habitat may no longer be able to sustain the existing populations of aquatic species. If recovery of the springs or streams does not occur or is not adequate to restore the habitat, there would be irretrievable loss of aquatic wildlife. Mitigation measures have been identified for these potential effects, and if successful, would mitigate irreversible or irretrievable commitments of aquatic resources. Given the uncertainty of the potential loss of the surface expression of springs or seeps due to groundwater drawdown, it is also uncertain whether mitigation would be successful. If not, spring/seep loss would be irretrievable.

Residual Effects

Aquatic habitats associated with smaller tributaries to Maggie Creek could experience losses during the period of dewatering, but are expected to return to near premining conditions over a long time. The degree to which they fail to return to premining conditions would be a residual effect.

THREATENED, ENDANGERED, CANDIDATE AND SENSITIVE SPECIES

Direct and Indirect Impacts

Proposed Action

Bald Eagle

Bald eagles wintering along the Humboldt River would experience minor impacts due to the greater expanses of ice-free water in winter. Discharge of water at temperatures within 2°C of Humboldt River water would slightly increase the amount of ice-free water and attract migrating and wintering waterfowl, a potential food source for eagles. Eagles might be exposed to increased concentrations of metals and trace elements if fish tend to biomagnify those elements. After discharge from Gold Quarry dewatering ceases, some reaches of the Humboldt River below Carlin may have reduced baseflows due to the cone of depression. Periodic cessation of flow probably would reduce fish populations. This impact would be minor because eagles within the project area primarily rely on jackrabbits and carrion for winter food.

Lahontan Cutthroat Trout

No habitat containing Lahontan cutthroat trout would be directly affected by the incremental expansion of the 10-foot drawdown contour (**Figure 4-19**). Potential indirect effects on the trout remain as they were analyzed in the original EIS (BLM, 1993). The SOAPA

would serve to extend the same kinds of effects to approximately 2011. Actually, the groundwater modeling for the SOAPA essentially removed approximately 4.5 miles of middle Maggie Creek from within the 10-foot drawdown contour, thereby reducing the potential somewhat, for effects on that reach of stream. Additionally, Maggie Creek is fed by 34 feeder streams, only one of which is predicted to be affected by dewatering in their headwaters, so the potential for dewatering effects on the mainstem of Maggie Creek may be masked by flow contributions from the feeder streams not potentially affected by drawdown. Potential effects on Maggie Creek are expected to remain as described in the original EIS (BLM, 1993). Potential LCT re-introduction habitat in Susie Creek is also predicted to have reduced baseflows (BLM, 1993).

Lahontan cutthroat trout have been absent from lower Maggie Creek for decades as a result of degraded habitat conditions from livestock grazing, pre-project low baseflows, and the fact that lower Maggie Creek is a naturally losing stream and periodically went dry. Therefore, discharge of excess water into lower Maggie Creek and subsequent dewatering of the stream channel during groundwater recovery would not affect existing Lahontan cutthroat trout habitat.

Although Susie Creek is not currently inhabited by Lahontan cutthroat trout, the Lahontan cutthroat trout Recovery Plan has identified it as a potential Lahontan cutthroat trout reintroduction stream (USFWS, 1995). Susie Creek baseflow near its confluence with the Humboldt River, is predicted to decrease from 0.8 to 0.6 cfs due to implementation of the SOAPA and cumulative mining actions in the region (see Chapter 4, Water Resources Section). These effects on Susie Creek are expected to occur in the lower reach near its confluence with the Humboldt River.

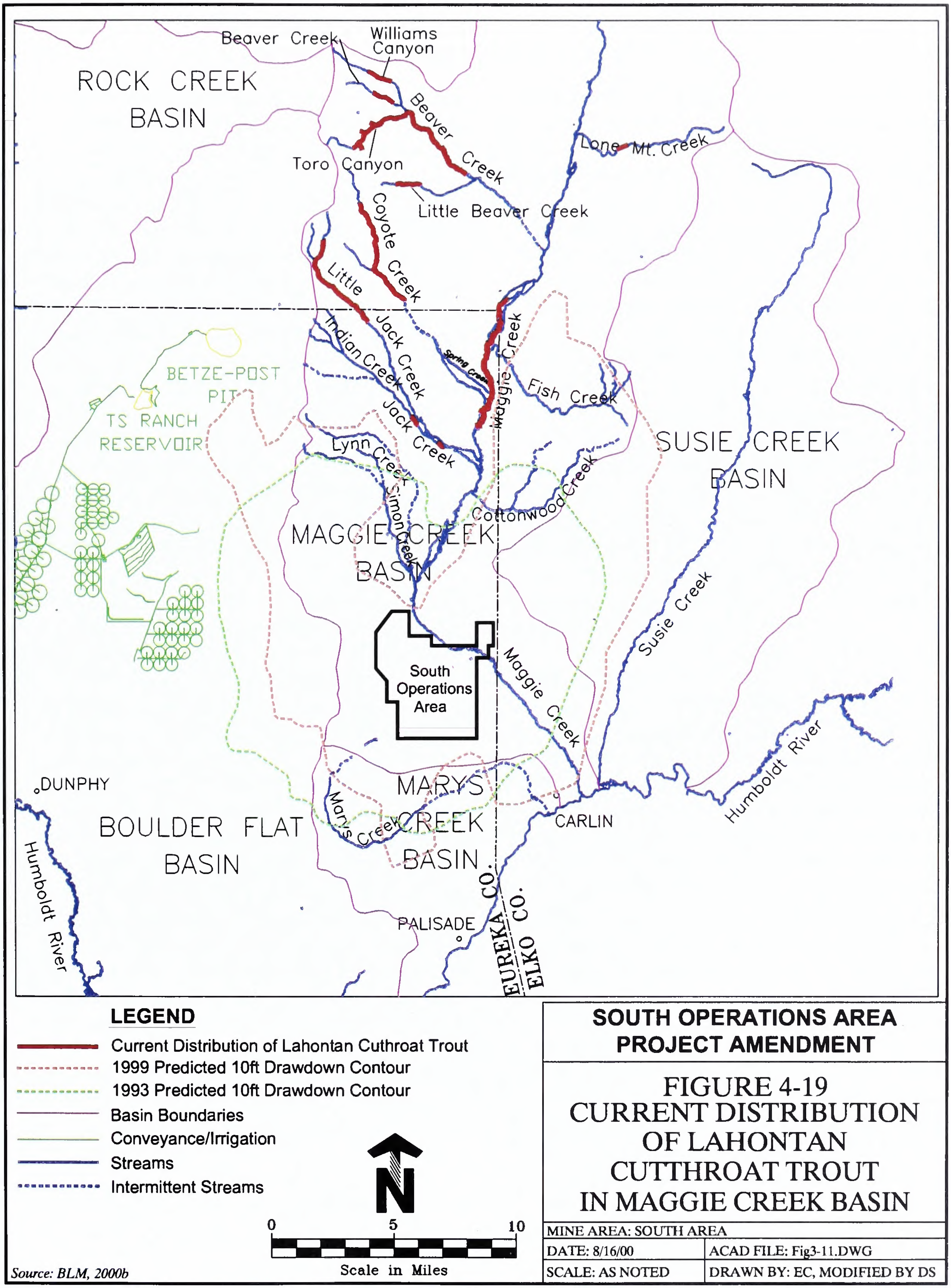
Columbia Spotted Frog

Mine dewatering is not expected to affect any of the perennial surface water reaches in the Maggie Creek subbasin where spotted frog populations have been found (Maggie Creek upstream of the Coyote Creek confluence, Little Jack Creek, Spring Creek, and Coyote Creek). All these locations are more than one-half mile outside the 10-foot drawdown contour, and spring sources contributing to these streams are also outside the drawdown contour.

Other Species of Concern

Potential direct impacts from dewatering to certain BLM sensitive species, could result from habitat destruction and degradation, displacement from habitat, and reduction of wetlands and riparian zones. The original EIS (BLM, 1993) fully discussed the potential impacts to wildlife species of concern, and the expansion of facilities for SOAPA would continue those impacts in kind and magnitude. The following discussion represents a summary of potential incremental impacts expected from the expansion.

Potential impacts to ferruginous hawks, burrowing owl, and northern goshawks would be less than the minor effects identified in 1993. The potential long-term loss of some seeps, springs, and stream reaches within the incremental area of potential impact to surface waters could reduce the amount of potentially available habitat for Preble's shrew. Various bats including Townsend's big-eared, long-legged myotis, long-eared myotis, fringed myotis, small-footed myotis, and spotted bat would be anticipated to experience less than the minor effects identified in 1993.



Source: BLM, 2000b

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-19
CURRENT DISTRIBUTION OF LAHONTAN CUTTHROAT TROUT IN MAGGIE CREEK BASIN

MINE AREA: SOUTH AREA	
DATE: 8/16/00	ACAD FILE: Fig3-11.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY DS

However, if metals and trace elements are elevated in the pit lake, bats (and raptors) would be exposed to those increased levels.

Potential effects on white-faced ibis, least bittern, and black tern would experience effects less than those considered low in 1993. However, these birds could possibly be exposed to elevated levels of metals and trace elements as they forage along the Humboldt River. This exposure, while unlikely to be lethal, may have sublethal effects over time that might affect overall health of the birds. Effects on the Nevada viceroy butterfly were related to potential habitat loss and the losses would be less than were identified in 1993. The Proposed Action would extend the potential effects in time.

Springsnails are considered important because of their restricted distribution and native origin. Springsnails are present in 10 springs in the region. None of these springs are within the 10-foot drawdown contour, therefore there should be no effects to spring snail populations.

No sage grouse leks would be impacted directly by the proposed incremental expansion. The pit expansion of 139 acres represents a permanent loss of sage grouse habitat because the pit would not be reclaimed following mining. The groundwater drawdown would potentially affect areas of wetland habitat at several springs and seeps. The loss of these vegetation types would serve to eliminate brood-rearing habitat at these sites, potentially altering the sage grouse distribution during summer and autumn, and potentially reducing the total sage grouse population.

Improvements to riparian habitat conditions within the (BLM, 1993) predicted zone of impact should mitigate potential impacts to the California floater. In addition, if the annual recalibrated model extends the drawdown contour to that portion of Maggie Creek where two California floaters were found, or if the groundwater level in well MAG-A (described in the Water Resources Section) falls to less than one foot above the elevation of the bed of Maggie Creek, then a study could be conducted by a third party agreeable to Newmont and the BLM to determine if a viable population of California floaters exists in this reach of the creek. If the groundwater level in well MAG-B falls to less than one foot above the elevation of the bed of Maggie Creek at that location, Newmont would initiate, within fourteen days, consultation with the BLM concerning possible augmentation of Maggie Creek below the confluence of Coyote Creek and Maggie Creek.

Alternatives

Under the action alternatives, the 10-foot drawdown contour would expand and incrementally affect five seeps and springs. This combined with the additional 10 years of drawdown could adversely impact potential aquatic habitat for certain species of concern. Some species or individuals of bats displaced by potentially reduced surface water resources would be able to utilize the pit lake as foraging habitat.

Backfilling of the Mac Pit

Impacts to the threatened, endangered and BLM sensitive species as a result of this alternative would be similar to those described for the Proposed Action. The only difference would be that the Mac pit would be backfilled with waste rock. By placing the waste rock back into the Mac pit, 40 acres of wildlife habitat would be made available and the size

of both the North and South WRDF's would be reduced by approximately six acres. This would result in less potential habitat for the ferruginous hawk being lost under the WRDF's.

Modified Waste Rock Disposal Facilities

This alternative is essentially the same as the Proposed Action, except for the handling of the waste rock. Under this alternative some waste rock would be hauled to various areas for road and embankment construction. In addition, the South WRDF would be constructed higher rather than larger in area. This would result in 50 acres less potential wildlife habitat being lost within the footprint. This alternative would also result in three fewer acres of disturbance for a water diversion being constructed around the South WRDF.

No Action Alternative

The No Action alternative would result in the same potential impacts on threatened, endangered, candidate and special status species that have been stated in the original EIS (BLM, 1993). Under the No Action alternative, mining operations, including dewatering activities, would cease in 2001.

Potential Mitigation and Monitoring

Impacts that were predicted to occur as a result of the existing South Operations Area Project were mitigated by Newmont by implementation of the associated Mitigation Plan (BLM, 1993). Many items have been completed or are currently being implemented. A summary of items in the plan was presented in the Aquatic Habitat and Fisheries section earlier in this chapter.

Recent field reconnaissance surveys and BLM monitoring reveal that these mitigation procedures are effective in providing mitigation for the existing project (BLM, 1997a). Riparian and aquatic habitat in Maggie Creek, Little Jack Creek, Coyote Creek and other tributaries have improved dramatically since initiation of the restoration efforts. Recommendations for mitigation of the proposed amendment would be to continue with the current mitigation strategies.

Starting in 1993, Newmont and the TS Ranch have conducted a reseeding and improvement program in the Dunphy Hills area, much of which was burned and became dominated by cheatgrass, a poor vegetation for muledeer and sage grouse. Over 3,800 acres of public land have been seeded to grasses and other species, then over-seeded with sagebrush and rabbitbrush. These seedings are contributing to muledeer and sagegrouse habitat.

Additional mitigation recommended would be as follows:

- Potential mitigation could include replacement of the perched culverts with structures designed for fish passage at the road crossings of the Maggie Creek tributaries that have Lahontan cutthroat trout habitat. This might or might not increase the meta population potential of the Maggie Creek subbasin. The subbasin currently has low meta-population potential due, in part, to the culverts creating barriers to migration, and because lower reaches of several tributaries dry up after spring runoff.

- Newmont's commitment to provide baseflow augmentation in 1993 (BLM, 1993) would continue in force, if and when the need arises. More information is now available concerning rewatering for the restoration of fisheries and riparian values in dewatered streams. An example is Hill and Platts, 1998. "Ecosystem Restoration, A Case Study in the Owens River Gorge, California."

- Potential mitigation could include creation of a permanent migration barrier in lower Maggie Creek to eliminate the possibility of nonnative trout (primarily rainbow) from migrating from the Humboldt River into Lahontan cutthroat trout habitat in upper Maggie Creek.

- Simon and Jack Creeks have potential to be recovered for Lahontan cutthroat trout habitat. An intensive recovery program similar to that occurring in adjacent Maggie Creek tributaries could be conducted for dewatering mitigation.

- Newmont will continue to mitigate the potential effects of raptors and corvids (ravens and crows) on sage grouse, and other species of concern, as agreed to in 1993 (BLM, 1993) by ensuring effective and permanent (metal) anti-perching devices will be used to deter the use of powerlines and powerline structures as perches or nesting sites by raptors and corvids. Newmont agrees that any devices used would be maintained or upgraded for the life of the powerlines associated with the SOAPA expansion within the Newmont study area, through Newmont in coordination with the power company.

- It is recommended that Newmont survey the powerlines between the North and South Operations Areas to ensure the lines are raptor-proof. A sage grouse lek is present in the area and raptors have been observed using the powerline. Ensuring anti-perch structures are present would mitigate effects on sage grouse.

- 139 acres of sage grouse habitat must be rehabilitated as mitigation. The 139 acres of sage grouse habitat permanently lost to the pit expansion could be mitigated in other ways such as off-site habitat enhancement, creation of new water sources (guzzlers), additional protection for known leks, or other measures to be identified in the Final Mitigation Plan for the Record of Decision.

- Enhancement opportunities in Spring Creek should be evaluated. The stream looks promising but lacks salmonids (except for a marginal population of brook trout). Further evaluation of sediment loads, water quality, and habitat conditions is needed to determine restoration needs, as well as to monitor brook trout establishment, which would be catastrophic for Lahontan cutthroat trout. The Nevada Division of Wildlife plans on reintroducing Lahontan cutthroat trout to the stream as part of the Recovery Plan for that species.

Successful implementation of mitigation measures would eliminate residual adverse effects on other threatened, endangered, or BLM sensitive species.

In 1993, Newmont agreed to augment flows into ponds used by the Townsend's big-eared bat if the ponds were impacted. The ponds on Lynn's Creek washed out in spring 1993 and no longer exist (comment letter from D.J.

Vandenberg, 2-3-99), and this mitigation measure became moot.

Also in 1993, Newmont agreed to reclaim disturbed areas and enhance the final pit wall with constructed overhangs and alcoves for raptors. This mitigation measure is ongoing in the case of concurrent reclamation, but final pit wall enhancement would not be conducted until after mining ceases.

Irreversible and Irretrievable Commitment of Resources

There would be no irreversible or irretrievable commitment of resources that would affect threatened, endangered, or BLM sensitive species if the approved mitigation measures outlined in the original Mitigation Plan (BLM, 1993), are implemented.

Residual Effects

Successful implementation of mitigation measures would eliminate any residual effects on threatened, endangered, candidate or special status species. This conclusion is based on implementing all mitigating measures from the existing Mitigation Plan (BLM, 1993) plus additional mitigation measures identified in this EIS and in the Cumulative Impact Assessment (BLM, 2000b).

LIVESTOCK GRAZING

The Proposed Action would result in 71 AUMs on public lands in Section 18 being suspended. Following mining and reclamation, these AUMs would be available for grazing use. In addition, in the area of incremental groundwater drawdown and recovery, a total of 5 springs and seeps, 11 wells and groundwater rights (three of which are stock wells) , and 2 streams (Marys and Maggie Creek) within the study area could be affected through reduction or loss of baseflow **(Figure 4-20)**.

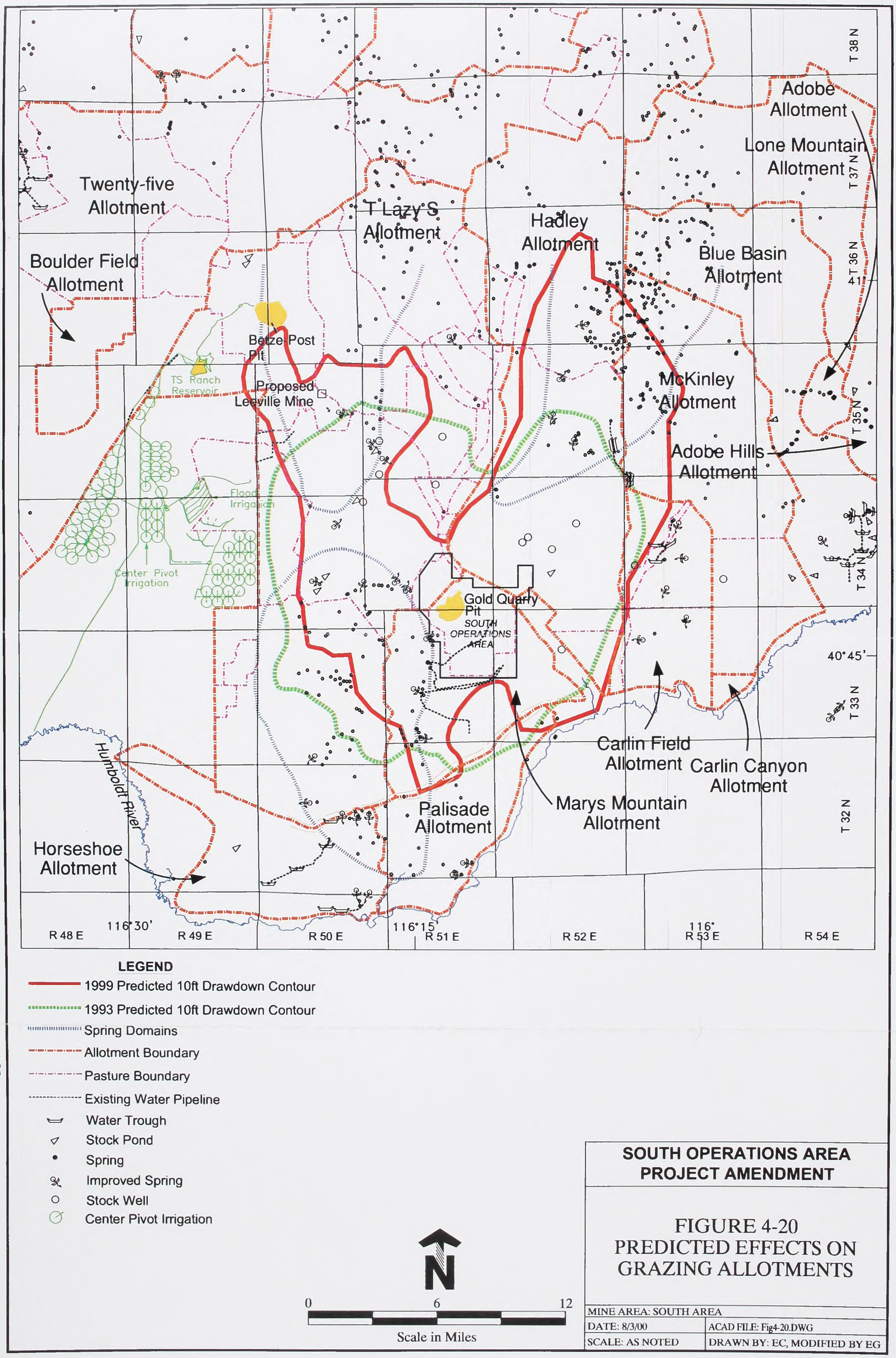
Livestock grazing in the study area would be affected by potential changes in stockwater availability associated with groundwater drawdown. If stockwater availability is reduced, it may result in permanent reductions in stocking rates or periods of use on some grazing allotments. Some areas would be permanently lost to livestock grazing because they are not reclaimable, e.g., the expanded mine pit would result in 139 acres lost to grazing. Some steep slopes remaining after reclamation would experience limited grazing, e.g., approximately 330 acres would be steep slopes.

Direct and Indirect Impacts

Proposed Action

The Proposed Action would have direct, indirect and cumulative impacts on the grazing resources within the project area. These impacts would arise from three sources, permanent loss of grazing lands (e.g., open pit), temporary loss of grazing lands, and the reduction of water sources.

The proposed Action would directly result in the temporary suspension of 71 AUMs on public lands in Section 18 in the Mary's Mountain allotment. This total loss would be in addition to those losses accounted for in the original EIS (BLM, 1993). Impacts to grazing would result from two phenomena; the direct impact of loss of forage (temporary and permanent) from fencing out Section 18, and indirect impacts from possible loss of area to graze due to loss of water resources. The resulting impacts include possible reductions in stocking rates, possible herd reductions, and



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 4-20
PREDICTED EFFECTS ON GRAZING ALLOTMENTS

MINE AREA: SOUTH AREA	
DATE: 8/3/00	ACAD FILE: Fig4-20.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY EG

possible reduced income for the ranchers. The loss of water sources may or may not require reductions in stocking levels based on the amount of water lost (all or only some), the period of its loss (entire grazing season or just late summer), availability of other water sources (developed or undeveloped), and the amount of mitigation of lost water sources (Newmont has committed to replenish or replace spring flows lost as a result of dewatering). The loss of forage areas would be restored (less the area of the pit) following mine closure and reclamation.

It is anticipated that the reduction in AUMs (because of steep slope areas) would be a long-term impact. Upon closure of operations, the areas fenced off from grazing would be reestablished as grazing lands. Original grazing improvements would be replaced, and the area would be revegetated with the appropriate cover. As a consequence of these activities, it is expected that the suspension of AUMs in Section 18 would be restored after the closure of the mine.

Continued dewatering of the Gold Quarry pit would affect both surface water and groundwater resources, and therefore stockwater sources. Potential impacts to livestock grazing from dewatering would include changes in livestock distribution and forage utilization. There are three known stock wells (of the 11 total wells) within the incremental 10-foot drawdown contour (**Figure 4-5** and **Table 4-1**). Impacts on these wells would depend on their depth and location within the groundwater cone of depression. Based on the assessment presented in the Water Resources section of this chapter, only the Meierhoff irrigation well (Section 26, T33N, R52E) with a known total depth could possibly be entirely dewatered.

Dewatering of the Gold Quarry pit could result in reduced baseflow or complete cessation of flow in five springs and seeps within the incremental predicted groundwater drawdown area (**Table 4-2**). Other springs have not been developed for livestock use, and they may also provide water for livestock. Loss of these springs would displace livestock from forage that would then be too far from water to be usable.

Two developed springs that could be impacted by incremental dewatering are in the Hadley allotment. Two developed springs are in the Marys Mountain allotment, and one is in the McKinley allotment (**Figure 3-12**). If other springs in these allotments keep flowing at some level, they may supply enough water to compensate for springs that could dry up.

The central portion of the Hadley allotment could have reduced water availability if the two springs discussed above are dewatered, and wells of unknown depth are dewatered. Reduced water availability may also change areas into "secondary areas" virtually unuseable because of the distance from water.

Similarly, if the two springs in the eastern portion of Marys Mountain allotment are dewatered, availability of water in the central portion of the Marys Mountain allotment could be impacted. The same situation would occur in the west-central area of the McKinley allotment.

Range improvements potentially impacted by the Proposed Action include spring and well developments mentioned previously and a boundary fence between Marys Mountain and T Lazy S allotments in Section 34 (T34N, R51W), on the west side of the SOAPA site. The boundary fence is currently within the

mine boundary, but will be rebuilt after mine closure.

Alternatives

The alternative to backfill the Mac pit would create approximately 40 acres of area suitable for grazing after reclamation and revegetation was complete. The 40 acres would be in the T Lazy S allotment and could provide additional AUMs compared to the Proposed Action.

The alternative to modify the James Creek and South WRDFs would allow approximately 53 acres to remain undisturbed by the WRDFs in comparison with the Proposed Action. The 53 acres are located in the Marys Mountain allotment and could represent AUMs not lost to the project.

No Action Alternative

The No Action alternative would have no additional impacts on grazing beyond those already permitted. The original EIS (BLM, 1993) predicted a reduction of 8,092 AUMs.

Potential Mitigation and Monitoring

Selected springs, seeps and streams would be monitored according to the approved Mitigation Plan. If any reduced flows are observed, the sources would be augmented or compensated by providing additional water in the same vicinity, as described in the Mitigation Plan. Forage lost could be mitigated by rangeland seedings in areas outside the cone of depression (BLM, 1993). Newmont has seeded over 6,500 acres offsite for range and wildlife habitat. Additionally, Newmont has conducted several fencing projects around springs to prohibit cattle and preserve spring functions.

Other measures could include additional fencing placed at spring sites to prevent trampling, alternative water sources could be provided through hauling or development of other wells or springs, changing the period of use to make maximum use of available water, or other mitigation measures could be identified for negotiation in the Final Mitigation Plan that will be developed for the Record of Decision.

Irreversible and Irretrievable Commitment of Resources

There would be an irretrievable commitment of forage lost during and following mining, and an irreversible loss of forage due to the pit expansion. If the Proposed Action is implemented, 71 AUMs would be irretrievably lost from the use of Section 18 for the life of the project. There would also be an irretrievable loss of livestock grazing potential for the amendment area until revegetation is sufficient to allow grazing to resume.

Backfilling the Mac pit would allow reclamation of 40 acres that would have been irretrievably lost. The desired land use for the 40 acres would be wildlife habitat and grazing.

Residual Effects

There would be a reduction in livestock numbers due to the permanent unreclaimed features (Gold Quarry pit expansion) and steep slopes (WRDFs and leach facilities). Eventual recovery of groundwater levels in the project area is expected to restore baseflow to springs and seeps to near pre-mining levels (or with augmentation water) that were affected by dewatering. However, the total recovery period could be nearly 100 years, and if

baseflows do not recover completely, that would constitute a residual effect.

RECREATION

The SOAPA would result in 1,392 fewer acres being available for recreational use after mining. No temporary workers associated with construction of new facilities are projected so there should be no impact to existing campgrounds and other recreationists in the area.

Direct and Indirect Impacts

Proposed Action

The potential effects of the construction and operation of the proposed facilities on recreation resources are based on how much opportunity is being lost for other recreation pursuits. The construction and operation of the proposed facilities can also affect recreation activities by altering the physical setting and visual quality of the recreation experience, by changing access opportunities, and by directly disrupting existing recreation activities. Direct impacts to recreation occur when available recreation lands are converted to restricted uses by proposed mine facilities.

The Proposed Action would not result in any increase in the level of visitation to existing recreational facilities identified in the original EIS (BLM, 1993). The only effect on recreation from the Proposed Action would be to extend existing levels of visitation on recreational facilities through the year 2011.

Land disturbed under any action alternative essentially would not be removed from existing recreation uses, as these lands are presently fenced to prevent public entry. The impacts to recreation opportunities, including the number of acres disturbed by the proposed amendment, in the project area and the Elko Resource Management Plan Area are common to all action alternatives. None of the alternatives would reduce recreation opportunities in the project area and the Elko area.

The mining activities under any action alternative would not require any additional workforce. It is anticipated that the current workforce would be sufficient for the mine expansion. There would be no change in the level of visitor use of recreation areas and facilities in Elko and Eureka counties resulting from the addition of employees to the project workforce.

There are no developed recreation areas within or near the project area. There would be no change in existing levels of dispersed recreation activities on public lands surrounding the project area as a result of the mine expansion under any action alternative. It is anticipated that the existing level of recreation activity would continue on these lands. In general, any acreage removed from existing land uses by project facilities would be insignificant relative to the area available for these uses in adjacent areas of public lands. Once mining operations have ceased and public access is reopened, dispersed recreational opportunities would become available in most of the area that was closed for public safety.

Alternatives

Neither of the action alternatives would have any different impacts on recreation opportunities than would the Proposed Action.

No Action Alternative

No additional impacts to existing developed and dispersed recreation resources would occur under this alternative. The existing condition of BLM lands in the SOAPA area would be maintained under the current management direction as defined in the BLM's Elko Resource Management Plan and Final Environmental Impact Statement (BLM, 1987).

Potential Mitigation and Monitoring

Mitigation measures for recreation consist of the proposed conservation easement along Maggie Creek that Newmont granted to BLM, as described in Chapter 3. Public access for recreation would be allowed after the Riparian Exclusion and Riparian Restoration Zones have had several years to recover. The Maggie Creek Restoration Project has been put in place and is being monitored. Newmont also agreed in 1993 to provide a conservation easement along middle Maggie Creek to allow hiking and fishing. The conservation easement is complete. The conservation easement would terminate when dewatering impacts cease, or when flow augmentation is no longer needed, or by year 2042. In any case, the easement would not exist past 2083.

Irreversible and Irretrievable Commitment of Resources

Recreation would be irreversibly affected by the removal of surface lands by the Proposed Action.

Residual Effects

Recreation opportunities would be somewhat diminished in the long-term by the removal of surface lands by development of the Gold Quarry pit.

VISUAL RESOURCES

Visual impacts of the Proposed Action and alternatives were analyzed using procedures set forth in the Visual Contrast Rating Handbook (BLM, 1986). Changes in the landscape from the Proposed Action and alternatives are compared with the characteristic landscape to determine the resulting degree of contrast in form, line, color, and texture. To assess the change in landscape, the dimensions of the proposed facilities (length by width by height) were estimated in **Table 2-5.** The facilities could then be visually assessed against the existing landscape. Typically, facilities ranged up to a height of 400 feet and some had lengths greater than a mile. If the degree of contrast does not meet the Visual Resource Management objectives, the project should be redesigned or mitigation measures proposed. As noted in Chapter 3, most of the project site is located on Class IV land.

A small portion of the Maggie Creek and James Creek WRDFs would be located in a Class III VRM area. Objectives for Class III areas are to partially retain the existing character of the existing landscape. Because the acreage of disturbance is small relative to the total acreage of the Class III lands, and the final landforms of the WRDFs would be shaped during reclamation to blend with adjacent landforms, the Class III objectives would be met.

Contrast rating worksheets were completed from three key observation points (KOPs); these worksheets are included in **Appendix B**. The KOPs were selected to represent typical views of project features from within the affected area.

Visual simulations of appearance of the Proposed Action at the height of mining and after reclamation, were prepared to aid in this process. The three KOPs are described in Chapter 3 and shown in **Figures 4-21 through 4-23.**

Direct and Indirect Impacts

Proposed Action

The primary impact of the Proposed Action would be large-scale modification of landforms. Angular, blocky forms and horizontal lines would create moderate contrasts with the natural rounded, rolling hills and ridges of the characteristic landscape. The expansion of existing facilities would not create as strong contrasts as the creation of new land forms in an undisturbed setting.

Construction of leach pads and waste rock disposal facilities would expose soil and rock material in a variety of colors ranging from light grayish tan to reddish tan to very dark gray. Existing facilities indicate that most would be middle shades of tans and browns. Contrasts between these colors and those existing in the landscape would range from moderate in bright sunlight and when front-lighted to weak in overcast conditions and when back-lighted. Color contrasts would be reduced following successful reclamation and revegetation.

Visual impacts from new structures would be small when compared with the visually dominant waste rock disposal areas. The Gold Quarry pit would not be reclaimed but only the top of the high wall would be visible from any of the KOPs.

Visual contrasts between the natural landscape and the existing steam plumes from the roaster plant and the cooling tower would continue until the year 2011.

New structural features associated with the SOAPA Project would be limited to expansions of leach pads and waste rock dumps. Because of their proximity to existing structures, the new features would not appear as large structures in comparison with the visually dominating existing structures. Consequently, visual contrasts introduced by expanded structures would be weak.

When viewed from KOP 1, the Proposed Action would contrast weakly with the existing landscape as mine facilities are in the foreground- middleground, more than four miles away (**Figure 4-21**). The new structures in Section 18 would be closest to viewers while all other facilities would be largely screened by existing facilities. The new facilities would be substantial landform modifications, however, they would be visually coherent with existing modifications that currently exist in the view from KOP 1. The project would increase the physical extent of visual effects but would not introduce stronger degrees of contrast than currently exist nor would it introduce new types of landforms, lines, colors, or textures. In addition, existing visual impacts in the foreground reduce the visual dominance of mining activities from this KOP. Views of the mine by motorists on Interstate 80 (a distance of about 1.3 miles) would be decreased from approximately 75 to 65 seconds as a result of the higher speed limit now in place.

The project as viewed from KOP 1 would be consistent with the objectives for Class IV areas, which permit visual modifications to dominate the view.

Construction of the Property Leach Pad 2 and expansion of the Non-Property Leach Pad would be readily apparent from KOP 4 (**Figure 4-22**). This would be overshadowed by the much higher and more visually dominant mountain backdrop. As at other KOPs where existing mining operations are visible, no new landscape elements would be introduced; visual contrasts in form would remain moderate, while contrasts in line, color, and texture would remain weak.

Views of the proposed action from KOP 4 would be similar to those from KOP 1 except the proposed facilities would be in the middle-ground at a distance of approximately two miles. Views for a traveler on Highway 766 would be interrupted by a ridge immediately west of the highway. The steam plumes from the existing roaster and cooling tower would continue to be visible, especially during cool, wet weather. The plumes would be visible from all three KOPs. Color contrasts from the light colored earth materials would be noticeable as the new facilities would be closest to the viewer. No new form or line contrasts would be created. The pit high wall is visible from KOP 4 with the benches presenting weak line and color contrasts.

The project as viewed from KOP 4 would be consistent with the objectives for Class IV areas, which permit visual modifications to dominate the view.

Views of the proposed action from KOP 6 would be dominated by the existing facilities because the KOP is only approximately one mile northeast of the facilities (**Figure 4-23**). However, the proposed expansion of the Gold Quarry North WRDF is farther to the west (1.5 miles) and the proposed expansion of the Non-property Leach Pad and construction of the Property Leach Pad 2 would be more than three miles to the south.

The proposed expansion of the Gold Quarry North WRDF would screen some natural features as seen from KOP 6, but would also partially screen the pit high wall. The Proposed Action would extend the existing lines and forms, especially to the south where facilities in Section 18 would extend the long unbroken line by a little more than one-half mile.

The project would increase the physical extent of visual effects but would not introduce stronger degrees of contrast than what currently exists, nor would it introduce new types of land forms, colors, or textures. Revegetation would provide similar colors and textures to those that occur naturally (**Figures 4-21c, 4-22c, and 4-23c**).

Elevating the Gold Quarry North WRDF would essentially raise the skyline behind the existing transmission line and serve to provide more screening and less "skylining" of the transmission line when viewed from KOP6. The transmission line would remain in place to serve customers located north of the SOAPA area.

Class IV objectives permit high levels of change to the characteristic landscape and visually dominating project activities. Consequently, views of the Proposed Action from KOP 6 would comply with these standards. Class IV objectives do, however, require that every attempt be made to minimize the impact through repeating the elements of line, form, color, and texture, and

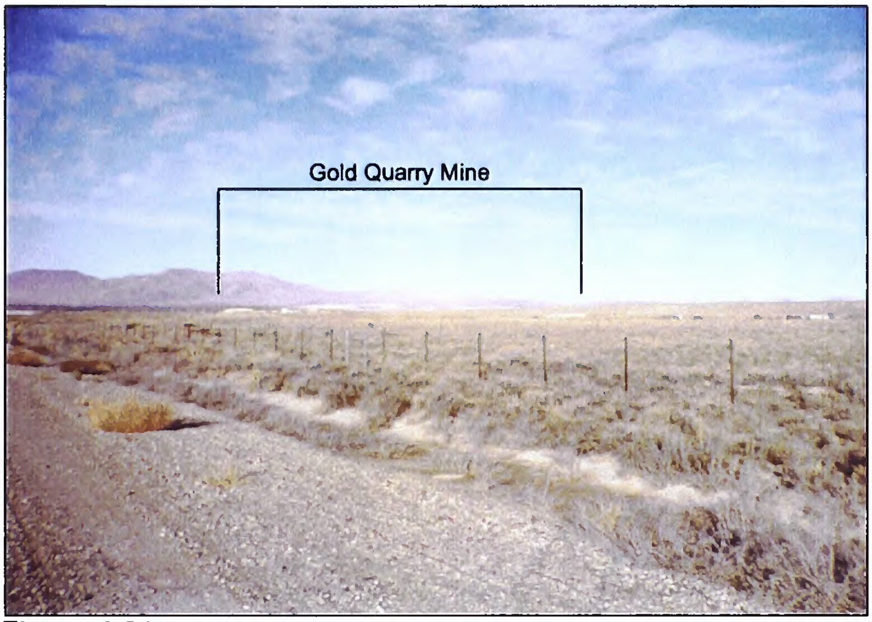


Figure 4-21a
Existing conditions from KOP1, SOAPA Project

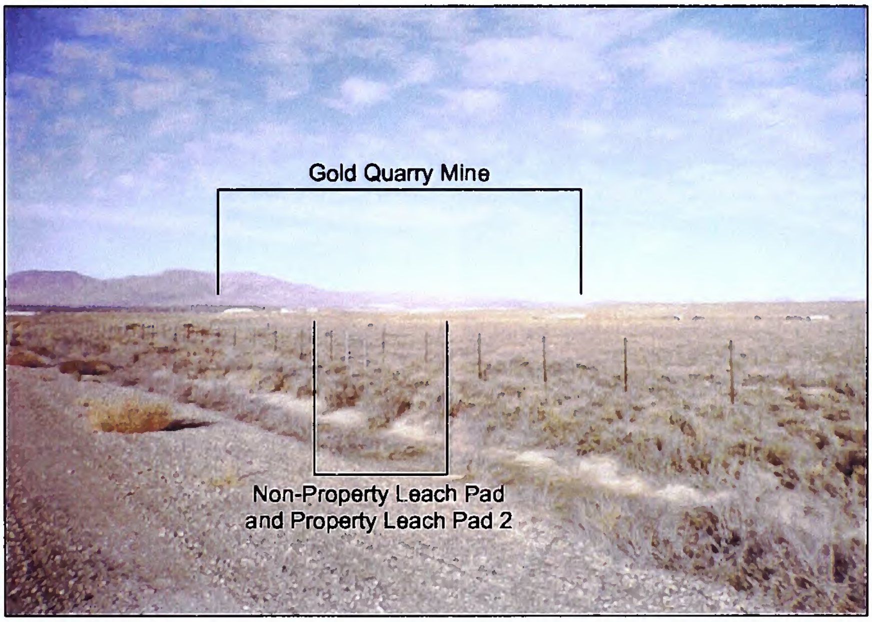


Figure 4-21b
Peak mining conditions from KOP1, SOAPA Project

Figure 4- 21c
Post-reclamation conditions from KOP1, SOAPA Project

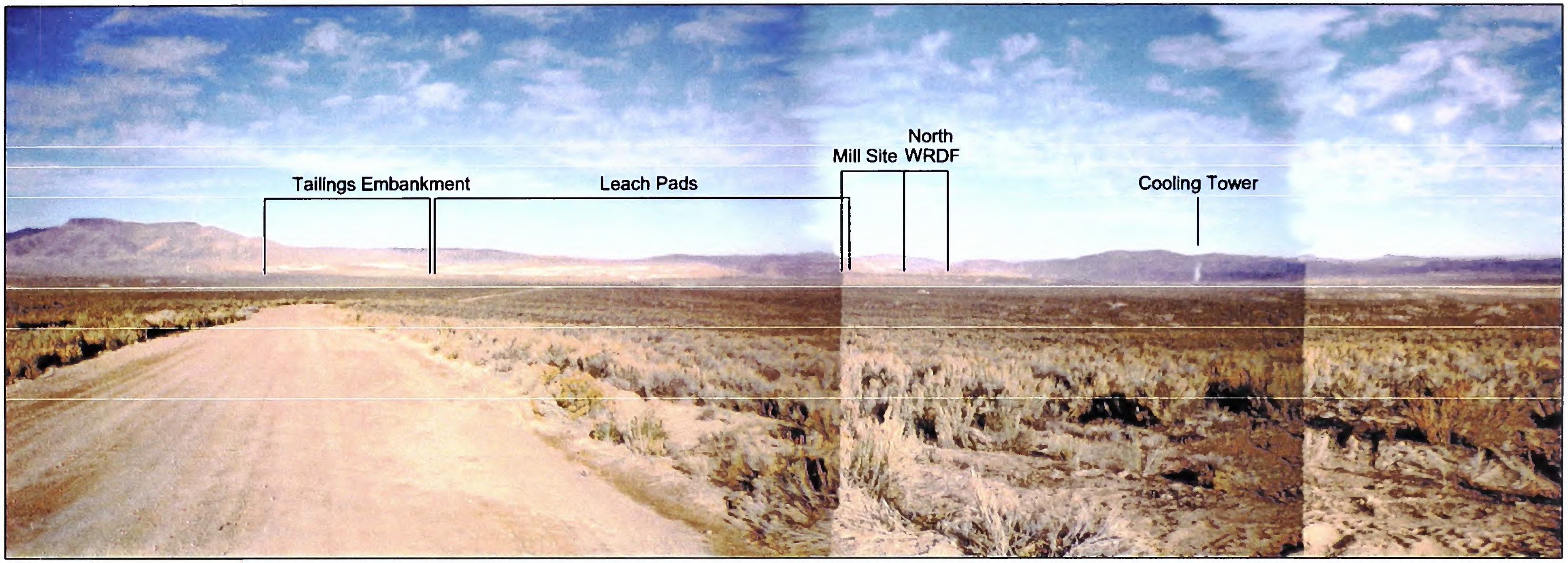


Figure 4- 22a
Existing conditions from KOP4, SOAPA Project

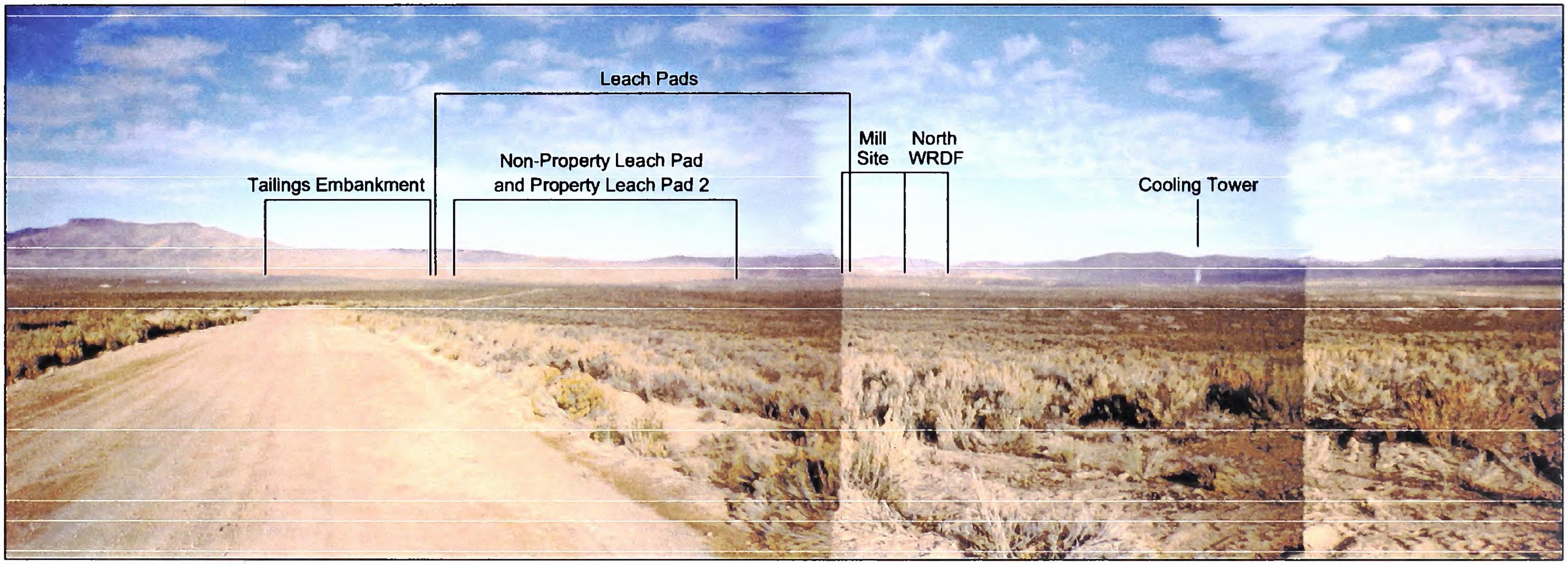


Figure 4- 22b
Peak Mining Conditions from KOP4, SOAPA Project

Figure 4- 22c
Post-reclamation conditions from KOP4, SOAPA Project

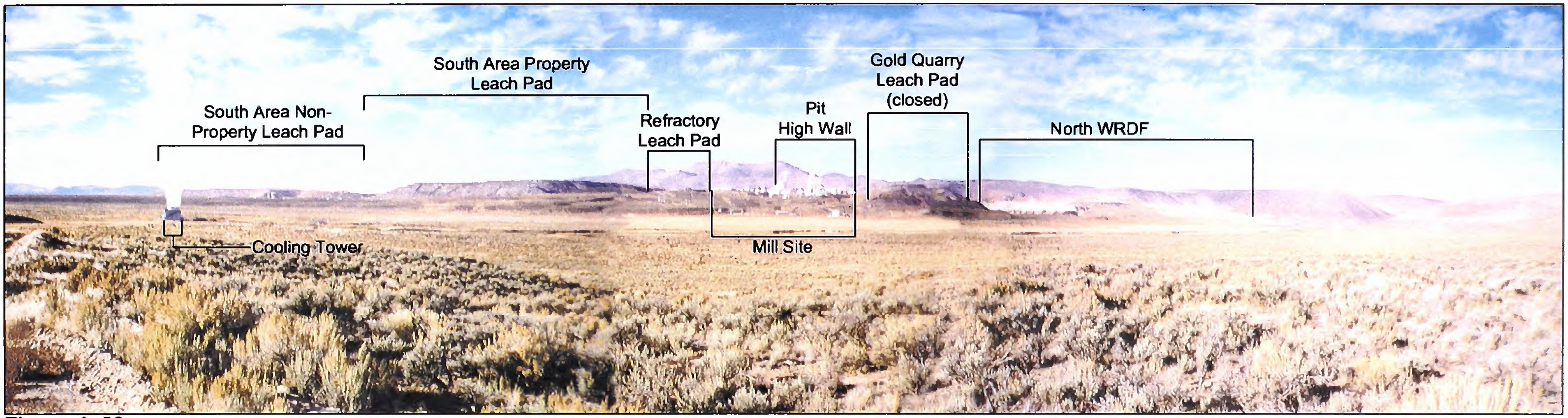


Figure 4- 23a
Existing conditions from KOP6, SOAPA Project

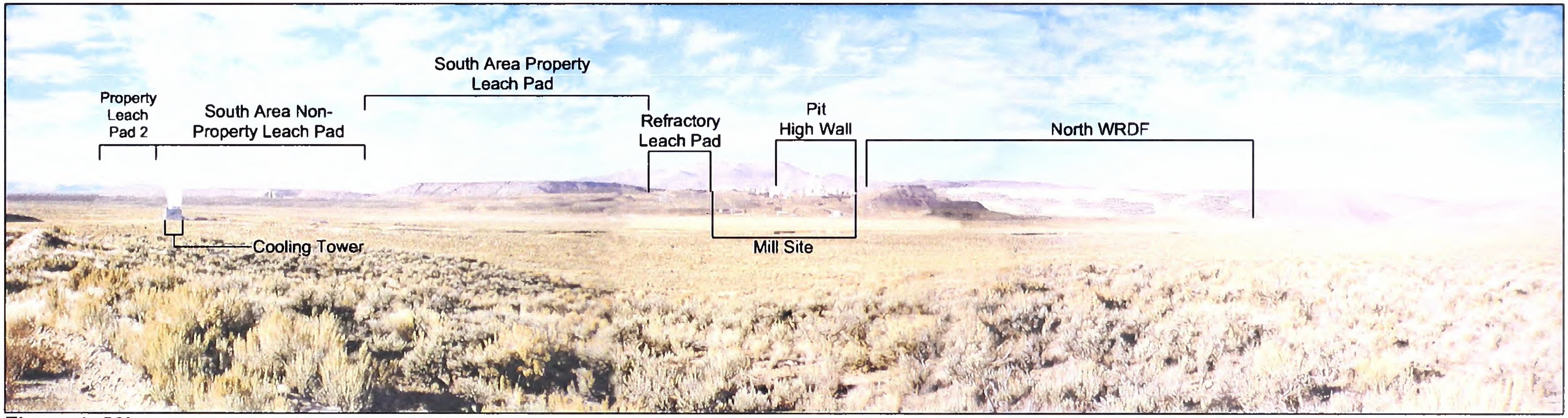


Figure 4- 23b
Peak mining conditions from KOP 6, SOAPA Project

Figure 4- 23c
Post-reclamation conditions from KOP6, SOAPA Project

these are to be addressed by the approved Reclamation Plan.

Night-lighting required by the Proposed Action activities would result in a visible glow apparent within and around the project area including all three KOPs, during the life of mining and processing. The incremental increase in night lighting required for safety and security at the new facilities proposed for SOAPA would not be sufficient to increase the magnitude nor extent of the existing visible glow that is apparent within and around the project area, including all three KOPs. The proposed action would extend the presence of the existing glow until 2011. Following ore processing, lighting would be removed during the reclamation period until all lighting was removed.

Alternatives

Backfilling of the Mac Pit

The Mac pit backfill alternative would not increase the visual impact of structures in the proposed action. The alternative to backfill the Mac pit would reduce the size of WRDFs by about six acres, which would not be noticeable. Backfilling the Mac pit with waste rock from the Gold Quarry pit would result in a minor reduction (less than a 50-foot lift on the North and South WRDFs) in the height of the other WRDFs. The Mac pit would contain approximately 2 percent of the waste rock to be generated by the SOAPA project. Backfilling the Mac pit would not provide any visual benefits, as it is not visible from any of the KOPs. Impacts on visual resources would remain essentially the same as those resulting from the Proposed Action. The alternative to modify the WRDFs would reduce surface disturbance by approximately 50 acres. The reduced surface disturbance would be in the southwest part of the project area and unlikely to be noticeable from any of the KOPs.

Modified Waste Rock Disposal Facilities

The modified WRDF Alternative, by placing an additional 50-foot lift on top of the Gold Quarry South WRDF, would create a taller and somewhat narrower landform than the Proposed Action. This would make the Gold Quarry South WRDF more noticeable from KOPs 1 and 4 than would the Proposed Action.

No Action Alternative

Under this alternative, only those kinds of actions currently permitted would continue. It would not, however, reduce the degree of visual disturbance already existing from ongoing activities at the site. As mining operations cease, the project area would be reclaimed according to the current reclamation plan. This would result in reduction of the visual impacts of existing disturbance. Additional visual impacts from the Proposed Action or alternatives would not occur.

Potential Mitigation and Monitoring

Mitigation measures have been developed to minimize visual impacts. The objective is to reduce visual contrasts and is based on three concepts: (1) siting facilities in less visible areas; (2) minimizing disturbance; and (3) repeating the basic elements of form, line, color, and texture. In addition to measures included in the Proposed Action, the following measures could be applied to minimize visual impacts of the proposed action and alternatives:

- Slope gradients on embankments (between 3H:1V and 2.3H:1V) could be varied to create diversity of form and reflect the naturally rolling, rounded forms of the existing topography. This would also provide more diversity for vegetative communities.

- Edges of embankments could be rounded to reduce the angular appearance and soften edges or by dumping dark materials on top of light-colored materials.

- Contrasts in color of bare rock surfaces could be minimized by using commercially available chemical staining agents.

- Clearly defined construction limits should be established. Construction limits should use irregular shapes that reflect existing forms and patterns.

- Revegetation should be planned so that colors and textures blend with undisturbed lands. A mosaic of vegetative types would be preferable to monocultures.

- When additional lighting is added to new facilities, mitigation against nighttime light and glare can be provided by ensuring that new lighting is hooded to direct illumination downward and inward toward the facility, and by keeping the lighting supports as low as reasonable.

In 1993, Newmont agreed to incorporate landscape considerations in final landform design to ensure stable landforms which are geomorphologically congruous with adjacent topography. This mitigation measure, including the use of a landscape architect, would not be implemented until the last years of mining operations.

Irreversible and Irretrievable Commitment of Resources

An irretrievable commitment of visual resources would occur during the active mining period (approximately 10 years). Impacts on visual resources would be reduced through implementation of the proposed mitigation measures.

Residual Effects

Following successful implementation of reclamation measures, the most noticeable residual effect of the Proposed Action and alternatives would be contrasts in form, line, and color which would remain. Weak contrasts would result from the prismoidal forms and straight lines of the reclaimed waste rock storage embankments, tailing impoundments, and leach pads. Finer and more uniform soils in these areas would also create weak contrasts in texture with the existing landscape. A small area of the upper highwall of the Gold Quarry pit could be visible from KOPs 4 and 6 (**Figures 4-21c and 4-22c**).

NOISE

The SOAPA project would result in a continuation of noise generated by mining and ore-processing activities. The noise generated would not impact the town of Carlin, the closest sensitive receptor to the South Operations Area Project.

Direct and Indirect Impacts

Proposed Action

Major sources of noise from the SOAPA project would be the same as those from the

existing mining and processing operations: rock drilling, blasting, loading of waste rock and ore, truck hauling, and ore crushing and milling. The same types of equipment currently in use would continue to be used for the mine expansion. Blasting in the Gold Quarry pit would be concurrent and occur once a day but noise levels would decrease as pit depth increases. It is assumed that the human and wildlife populations have acclimated to the existing noise levels over the past seven years.

Alternatives

Noise levels would increase slightly south of the project boundary with the construction and operation of the Property Leach Pad and expansion of the refractory and Non-Property leach pads. This slight change in location of project noise would be partially offset by the increased depth of the Gold Quarry pit. Noise from drilling, blasting and mining operations in the mine pit would be muffled by the ever increasing height of the pit walls.

No Action Alternative

Under the No Action alternative, mining operations would cease around 2001. Noise levels would gradually decrease during the reclamation process, and then return to pre-mining levels after reclamation is complete.

Potential Mitigation and Monitoring

No mitigation or monitoring for noise effects would be necessary.

Irreversible and Irretrievable Commitment of Resources

There would be no irreversible or irretrievable commitment of resources as a result of noise effects from the Proposed Action.

Residual Effects

There would be no residual effects to the public resulting from noise generated during operations, and after mine closure, noise would be reduced to much lower levels.

LAND USE AND ACCESS

Direct and Indirect Impacts

Proposed Action

The South Operations Area Project Amendment consists of Newmont-controlled disturbance areas adjacent to mostly public lands managed by the BLM. The public lands support primarily grazing activities and include small amounts of disturbance from historical mining activities. Direct impacts to land use result from the disturbance area required by proposed mine facilities. Indirect effects to land use affect the area surrounding the project.

Under each action alternative, mining and mineral exploration would be the predominant land uses during the life of the project. The amount of ore mined would be similar under each action alternative.

Post-mining land use objectives include providing for wildlife habitat, livestock grazing, recreational use and the restoration of an aesthetically pleasing viewshed that is compatible with the natural setting. These post-mining land use objectives would be accomplished on public lands through implementation of a reclamation plan approved by the BLM. Reclamation on private lands would use the same reclamation plan but could be modified by landowner wishes.

Land Status

Most of the mining and processing facilities in the South Operations area are on private lands owned or controlled by Newmont. The proposed facilities would extend onto federal lands administered by the BLM Elko Field Office and on Newmont-controlled private property. **Table 2-5** summarizes the incremental disturbance acreage for each proposed facility expansion on public and private lands. The proposed surface disturbance on public lands is 839 acres, or 60 percent of the total proposed disturbance of 1,392 acres. Disturbance on private land accounts for the remaining 553 acres (40 percent). This is a 15 percent increase over the existing and permitted surface disturbance of 7,960 acres.

Land Use

Existing land use in the South Operations area is primarily mining and ore processing. The primary effects of the Proposed Action on land use would be to extend the duration of mining operations through the year 2011 and to increase the acres of disturbance from mining activities. Other land uses within and adjacent to the South Operations Project Area include grazing and wildlife habitat. The impacts to wildlife are discussed in Chapter 4 - Terrestrial Wildlife. Grazing is analyzed in the Livestock Grazing section of Chapter 4. Recreation is not a significant land use of the South Operations Area, as discussed in Chapter 3 - Recreation.

Land use within the proposed disturbance areas adjacent to existing mine disturbance would shift temporarily to mineral development for the life of the mine. Areas surrounding active operations and reclaimed mining areas would continue to serve as wildlife habitat and grazing land during project operations. Land uses requiring public access would be excluded from plans for post-mining reclamation. Reclamation and final closure of mining operations would reestablish the land uses of grazing and wildlife habitat in the disturbance areas under all of the action alternatives.

The federal oil and gas lease and gas pipeline would not be affected, as the pipeline carrying gas from the lease is existing and has been accommodated in project planning. The four utility rights-of-way would also not be affected. There may be need for minor relocations of the utilities for telephone, power distribution lines, and Newmont's natural gas pipeline, but such relocations would be instituted at Newmont's request and paid for by Newmont in negotiations with the utility suppliers. After operations cease, the telephone lines, power distribution lines to the mining operations, and the gas supply pipeline would be removed. The road right-of-way (Highway 766) would remain as would the Sierra Pacific powerline across the northern portion of the project area.

Public Access

Land uses such as recreation and grazing are directly related to the availability of access to public lands. Standard Newmont procedures

for developing access roads are to limit service and access roads to nonsensitive locations that avoid critical wildlife habitats.

There would be no change in public access on existing roads from any action alternative. Public access into the South Operations Project Area would remain the same as access available under existing conditions. Public access into the area would be provided by two corridors that would be designated from State Highway 766.

Reclamation and final closure of mining operations would reestablish public access into portions of the disturbance areas under all of the action alternatives. Public access would be restricted around the pits for safety reasons.

Land Use Planning and Management

NEPA implementing regulations require discussion of possible conflicts with federal, regional, state, and local land use plans (40 CFR 1502.16(c)). The Proposed Action would be consistent with the Elko Resource Management Plan (BLM, 1987), which provides for multiple land uses. The Proposed Action would also be consistent with the Elko County Federal Land Use Plan. There is currently no land use plan for Eureka County.

Alternatives

The effects on existing land uses and management policies from the mine expansion are similar for each action alternative. All of the new disturbance acres in each action alternative would be removed from existing land uses of grazing and wildlife habitat. Proposed disturbance acres would also occur on land previously disturbed by the mining operation.

Backfilling of the Mac Pit

The alternative would consist of the same major project components as described for the Proposed Action. This alternative would result in the same number of disturbance acres on public and private lands as the Proposed Action except the backfilled pit would provide 40 acres of wildlife and grazing habitat on public land and six fewer acres of waste rock disposal facility disturbance.

The effects on existing land uses and public access opportunities from the implementation of this alternative would be identical to those described for the Proposed Action.

Modified Waste Rock Disposal Facilities

The Modified WRDF alternative would incorporate a different approach for handling waste rock disposal. Implementation of the alternative would result in WRDFs with slightly smaller footprints (53 acres). All other components are the same as those identified in the Proposed Action. The effects on existing land uses and public access opportunities from the implementation of this alternative would be identical to those described for the Proposed Action.

No impacts to existing land uses would occur under this alternative and no additional ore would be produced from the South Operations area once permitted operations have been completed. The existing condition of BLM lands in the South Operations area would be maintained under the current management direction as defined in the BLM Land and Resource Management Plan. It is expected that the existing mining operations at Gold Quarry would continue for the current mine life through the year 2001.

No Action Alternative

Mining operations have resulted in the restricted access to public lands in the vicinity of mine facilities for public safety. Under the No Action Alternative the existing mine area closed to public access would remain closed until final reclamation of the existing mine operations is completed and public access restrictions are lifted. Portions of the closed area may have been accessed prior to mining for grazing or recreation purposes. The closures would continue under this alternative until mining has ceased and reclamation is complete.

Potential Mitigation and Monitoring

In the 1993 Mitigation Plan for the South Operations Area Project (BLM, 1993), Newmont developed a reclamation plan with the goal of achieving the objectives of multiple land use. No additional mitigation is proposed.

Irreversible and Irretrievable Commitment of Resources

Lands removed during the expansion of the Gold Quarry pit would be irreversibly and irretrievably lost for future land uses.

Residual Effects

With the exception of the pit expansion, there would be no residual effects on land use following mine closure. Reclamation of surface disturbances would restore lands to post-mining land uses, including wildlife habitat and grazing.

CULTURAL RESOURCES

Direct and Indirect Impacts

This discussion will consider four alternative actions and their potential impacts to significant cultural resources: (1) the Proposed Action; (2) Backfilling of the Mac Pit; (3) Modified Waste Rock Disposal Facility; and (4) No Action. None of these alternatives would entail direct impact to significant cultural resources. In all cases the significant cultural resources are located in areas peripheral to the proposed actions or operations. Traditional cultural properties and areas of traditional cultural concern have also not been identified within the area of direct effect.

Proposed Action

The Proposed Action Alternative entails expansion of the Gold Quarry pit, additional topsoil piles, expansion of waste rock disposal facilities and modification of diversion ditches, as depicted in **Figure 2-3**. Six of the seven significant cultural resources are east of State Route 766, away from the proposed operations. The Proposed Action would not involve any new earthmoving disturbance in this area, and would not adversely affect any of these cultural resources. Site CRNV-12-3283 is in an area that is near proposed waste rock disposal facilities and diversion ditches. Although this site would not be directly impacted by the Proposed Action, there could potentially be indirect degradation of the resource as a result of increased traffic and activity in the vicinity. The Nevada State Historic Preservation Office has recommended that the latter site be protected by staking or signing an avoidance area around the property (Nevada State Historic Preservation Office, 1997).

Alternatives

Backfilling of the Mac Pit

Backfilling of the Mac pit with waste rock from the expanded Gold Quarry pit would reduce the needed extent of waste rock disposal facilities. Again, site CRNV-12-3283 might only be indirectly impacted by increased activity in the vicinity.

Modified Waste Rock Disposal Facilities

The Modified Proposed Action would entail modifications to the location and extent of facilities, stockpiles and ancillary disturbance as described in the Plan of Operations. The potential adverse impacts to significant cultural resources would be the same as described above for the Proposed Action Alternative.

No Action Alternative

The No Action Alternative would entail no expansion of the SOAPA project. This would not result in any direct or indirect impacts to significant cultural resources.

Potential Mitigation and Monitoring

All but one of the significant cultural resources are located outside the areas of proposed new mining disturbance. SHPO has recommended that site CRNV-11-3283 be protected by the staking or signing of an avoidance area around the documented extent of the resource (Nevada State Historic Preservation Office, 1997). A visible barrier at least 30 meters from the perimeter of the site is recommended to clearly demarcate an area where traffic or earth disturbing activities are prohibited. SHPO concludes that adherence to these stipulations would result in no effect to this significant property.

Irreversible and Irretrievable Commitment of Resources

Cultural resources represent a finite resource which cannot be replaced. Therefore, any disturbance that results in their destruction would constitute an irreversible and irretrievable commitment of resources.

Residual Effects

It has been amply demonstrated at other projects that the construction of new access roads into an area that has been difficult to access in the past provides unauthorized artifact collectors access to cultural resources that might otherwise remain inaccessible.

NATIVE AMERICAN RELIGIOUS CONCERNS

Consultation with the Western Shoshone occurred in two phases. Phase I involved consultation concerning the proposed areas of disturbance for the SOAPA project. No specific areas of religious or traditional importance were identified to the BLM in the direct impact area of the SOAPA.

In addition, Deaver (1993) found that:

1. Current use of the area of direct effects for spiritual or ceremonial purposes appears to be nonexistent (Deaver, 1993: page 44).

2. No cultural properties within the area proposed for mine expansion appear to fit the formal definition of traditional cultural properties (Deaver, 1993: page 46).

3. While human skeletal material (a mandible and 10 isolated teeth) was recovered in 1984 during the archaeological excavation of a rockshelter in the area, surveys in the area of direct effects have yielded no further evidence of graves (Deaver, 1993: page 46). Likewise, surveys in the area of direct effects have identified no associated funerary objects, unassociated funerary objects, sacred objects, or objects of cultural patrimony.

4. The South Operations Area is within the traditional territory of the Newe/Western Shoshone, and within the boundaries of the lands covered by the Treaty of Ruby Valley. Although specific properties or areas of concern have not been identified within the South Operations area, many traditionalist Newe/Western Shoshone maintain that they never ceded their traditional lands, and that they retain jurisdiction over public domain in this area. In the traditional worldview, disturbances such as mining disrupt the flow of puha (spiritual power) and lead to a dissipation of spirit life and degradation of sacred spring water. Some of the traditional value of the land is irreplaceable, but some measure of the loss of traditional resources can be lessened by reintroducing important native plants and animals in the reclamation plan (Deaver, 1993: page 45).

Phase II of the consultation effort involved potential cumulative impacts to Western Shoshone religious and traditional areas as a result of mine dewatering. Consultation with the Western Shoshone, however, is not yet complete. To date, consultation has focused on information gathering about areas of religious and traditional importance to the Western Shoshone. The BLM has not yet completed consultation with the Western Shoshone on potential effects to the Rock Creek and Tosawihi Quarries TCP's, nor to other issues of concern such as declining numbers of sage grouse. In addition, the BLM has yet to consult with the Nevada SHPO on the adequacy of its consultation effort, nor on the potential impacts of dewatering on the two eligible TCP's and how the BLM intends to prevent or offset these impacts. After the potential impacts have been clearly defined, the BLM will complete its consultation requirements with the Western Shoshone. This effort will entail consultation on the potential, foreseeable effects of mine dewatering on the two TCP's and on other concerns of the Western Shoshone, as well as an invitation to the Western Shoshone to provide input into how to prevent or offset these effects. The BLM will then finalize a monitoring and mitigation plan, and consult with the Nevada SHPO on its determinations of effect to the eligible TCP's and the adequacy of its monitoring and mitigation plan. This information will be documented in the Final EIS for this project.

Potential Mitigation and Monitoring

No direct or indirect effects on Newe/Western Shoshone traditional cultural values, practices, properties, or human remains are anticipated in the Gold Quarry area as a result of any of the proposed action alternatives. Therefore, no mitigation or monitoring measures have been proposed in the Gold Quarry area. Any monitoring and mitigation measures proposed as a result of cumulative effects due to mine dewatering will be detailed in the Final EIS for this project.

Irreversible and Irretrievable Commitment of Resources

Since no direct or indirect impacts on Newe/Western Shoshone traditional values, practices, properties, or human remains and cultural items are anticipated in the Gold Quarry area as a result of the Proposed Action, no irreversible or irretrievable commitment of resources is anticipated in this region. Adverse cumulative effects, if any, to the TCPs as a result of mine dewatering could constitute an irreversible and irretrievable commitment of resources.

Residual Effects

The continuation and expansion of mining, and the associated dewatering, at the Gold Quarry Mine "will contribute to the dissipation [sic] of puha and spirit life in the area" (Deaver, 1993:44). Increased traffic directly associated with the mining activities, and improvement of access would contribute to increased intentional and casual activity at significant cultural resource locations, to the degradation of biotic and mineral resources traditionally valued by the Newe/Western Shoshone, and to the disturbance of spirit life in the area. Dewatering activities affect spring and surface water flows within the proposed operations area, and throughout a wide surrounding area. The latter disruption of spring and surface water flows would affect the distribution of plants, animals and spirits important to the Newe/Western Shoshone.

There are no known ways to lessen disruption of spirit life or restore mineral resources affected by mining activities and dewatering, but traditionally important plants can be included in revegetation plans, and traditionally valued animals can be reintroduced into the area. Reclamation plans often include elements of recontouring, hydrology, and selective soil placement that restores and encourages native taxa, and those taxa valued by the Newe/Western Shoshone can be included in these considerations.

Residual effects to Newe/Western Shoshone traditional values and practices may occur in the Gold Quarry area as a result of the Proposed Action, but these effects are expected to be minor to negligible because consultation with the Western Shoshone has not specifically identified this area as an important spiritual or religious area. Any potential residual effects resulting from the cumulative effects of mine dewatering would be prevented or offset by the monitoring and mitigation plan developed for this project and included with the Final EIS.

SOCIAL AND ECONOMIC RESOURCES

Newmont projects that no additional permanent employees would be hired during the operational phase of the project. The South Operations Area Project Amendment would continue to affect local communities through continued retail sales and employment.

Economic impacts during operational phases of the project would include continued employment in the mining industry and secondary jobs in retail and service industries. In the event that additional employees are hired during the operational phase, any previously laid-off employees would be considered for employment. Income would continue to be produced, primarily in Elko County, from wages paid in mining and secondary jobs created by the Proposed Action.

Impacts to the local economy would also occur once the operational and reclamation phases of the project are completed under any action alternative. Closure of the mine could contribute to an overall decline in mine production in the counties. There would be an expected decrease in jobs, and decreases in payrolls, purchases, and tax payments. These declines could result in out-migration and community instability, and negative effects on County revenues. In addition, businesses may close or relocate outside of the counties, home values could decline, and the quality of life may decrease.

Direct and Indirect Impacts

The proposed plan of operations amendment for the South Operations Area Project includes the continued operation of the Gold Quarry Mine through the year 2011. While the project includes the expansion of existing facilities and the installation of several new project components, the Newmont Gold Company proposes to utilize the existing work force to initiate work on the expansion.

The amended plan of operations is not expected to increase the number of permanent operational personnel. The most notable effects of the amendment would be an extension of existing employee needs for housing and services in the cities of Carlin, Elko, and the community of Spring Creek through the year 2011, when the number of employees is expected to be reduced to levels required to decommission the operation and perform reclamation. Mine employees could contribute to city and county growth revenues through 2011. The extension of receipts of income generated from property, sales, and net proceeds taxes from the mine to city and county revenues are also expected to continue but at a reduced level, through 2015. Newmont projects that no additional permanent employees would be hired during the operational phase of the project. The number of permanent employees is expected to be kept at a relatively constant level.

Economic impacts during operational phases of the project would include continued employment in the mining industry and secondary jobs in retail and service industries. Income would continue to be produced, primarily in Elko County, from wages paid in mining and secondary jobs created by the Proposed Action.

Most property taxes and net proceeds of mining taxes would be paid to Eureka County, whereas most sales tax revenues would accrue to Elko County. Commercial and residential development induced by mine expansion in Elko County would increase revenues from property and sales taxes.

Proposed Action

Employment

Newmont proposes to use the existing work force to initiate work on the proposed project. No increase in permanent employment is anticipated with implementation of the proposed action. Newmont employs a total of about 2,950 workers in Nevada, of which they estimated that 1,000 workers are employed at the South Operations area. The existing workforce would also be utilized during the construction phase of the project, supplemented with independent contractors, numbering no more than 100 workers. The Proposed Action, together with other Newmont activities, would provide for long-term operations in this area, leading to a potential for stable employment for approximately 15 years.

Housing

Implementation of the proposed project is not expected to alter existing housing conditions or to create a need for additional housing in the project area.

Community Service Providers

The SOAPA project would have negligible impacts on government in Elko and Eureka counties. Over the last decade, city and county governments have functioned in an environment of rapid growth with stresses caused by increased population and demands for community services. Demands on government would not appreciably change with the Proposed Action.

It is not anticipated that any significant changes in demand for schools, or other public services such as law enforcement, fire protection, health care, or social services would be realized as a result of the Proposed Action. In addition, the project would not affect water, wastewater, solid waste or parks and recreation. To the extent that there are existing service deficiencies with regard to ambulance services as well as mental health services, these conditions would not be worsened by the proposed Newmont operations. Additionally, area school districts have become readily adaptable to changing student enrollments and frequently use modular facilities as necessary.

Government and Public Finance

The Proposed Action would result in an extension of mining activities at the Gold Quarry Mine through the year 2011. The proposal does not include an increased rate of production but instead proposes an extension of mining activities to the year 2011. Subsequently, revenues in the form of net proceeds of minerals tax, property tax, and sales and use taxes, would continue to be collected by Eureka and Elko Counties, as well as the State of Nevada.

In 1996, revenues paid to Eureka County from net proceeds of mining taxes amounted to approximately $3.8 million for the year. Sales and use taxes paid to the state attributable to Newmont projects totaled $13.8 million. Property taxes after construction are not known because assessed valuation is not known; however, property taxes would exceed the $3.6 million paid to Eureka and Elko counties in 1996.

Additionally, the Newmont project would continue to contribute to the local economy through sales taxes generated from employee spending. Sales taxes would be divided primarily among Elko County (Nevada), Salt Lake City (Utah), Twin Falls (Idaho), and Reno (Nevada), the areas where local residents most often purchase major items. Also, it can be assumed that wages paid in the mining industry would induce additional jobs in other economic sectors (Dobra, 1988).

Alternatives

Impacts on social well-being, community services, and housing in the study area with these alternatives would be essentially the same as under the Proposed Action. Impacts on economic resources in the study area with these alternatives would also be the same as under the Proposed Action.

No Action Alternative

With the No Action Alternative, existing mining would continue until 2001. After that date, the majority of the operational work force would be laid off. A limited number of

employees would be retained to decommission the operation and perform reclamation.

With cessation of mining at the South Operations area, the population of Elko County would eventually decline. More housing would become available and prices for buying or renting would decrease. Traffic also would decrease. Existing diversification of the local economy would help mitigate the effects of the mine closure.

Crime and other indicators of decreased social well-being (e.g., divorce, domestic abuse, suicide, alcohol and other drug abuse, and welfare rates) would probably increase in the short term after mining ceases. Eventually, the community would adjust to the loss of population and economic benefits. As previously discussed, boom-and-bust cycles have been part of the social history of the Elko area.

Reduction of the operational work force would increase unemployment rates, reduce wages, decrease taxes paid to Eureka and Elko counties, and stress public assistance programs. Many workers would likely remain in the Elko area and seek work at other mines, while others would move from the area.

Potential Mitigation and Monitoring

No specific mitigation measures are required by NEPA and none are proposed.

Irreversible and Irretrievable Commitment of Resources

There would be no irreversible and irretrievable commitment of socioeconomic resources associated with the Proposed Action or alternatives.

Residual Effects

Residual impacts would be as described under direct and indirect impacts.

WASTES - SOLID OR HAZARDOUS

Direct and Indirect Impacts

Proposed Action

No direct impacts from wastes, solid or hazardous, are expected from the Proposed Action because Newmont would continue to dispose of its non-hazardous solid wastes in its own permitted landfill or have wastes transported to the Elko County landfill. All hazardous wastes that would be generated on-site would be handled according to existing approved permits or would be disposed of according to local, state, or federal regulations. The Proposed Action would have the indirect impact of contributing wastes to the Elko and Eureka county landfills at a rate higher than prior operations.

For the first three quarters of 1999, Newmont reported to the NDEP an average of eight spills per quarter of all materials, liquid and solid, hazardous and non-hazardous, even including fresh water. Almost all spills were inside process buildings, a few were to soils, but none were to natural waters or waterways. The most numerous of these spills was of weak solution of sodium cyanide used in processing (about four spills per quarter). The NDEP report form calls for spills to be documented in pounds of material spilled. On that basis, the average spill of sodium cyanide was 0.27 pounds per spill (roughly 400 to 500 gallons of solution). Other hazardous materials spilled included ammonium thiosulfate, lime (solid and in solution),

sulfuric acid, and hydrochloric acid. All spills were contained and cleaned up in an appropriate manner according to state and federal regulations.

Newmont would continue to process ore under SOAPA at the same rate as at present. This means there would be no increase in the volumes or frequency of truck traffic carrying solid or hazardous wastes. As a result, no change in the truck accident rate, or in the frequency of spills of materials is anticipated. Newmont has prepared a Spill Prevention Control and Countermeasures Plan as part of their designation as a major generator of hazardous wastes. The spill control plan would continue to be implemented as the major means of avoiding spills and properly cleaning up those that do occur.

Alternatives

No impacts from wastes would be expected from either of the alternatives because all processes which generate or handle wastes would be the same as the Proposed Action.

No Action Alternative

No impacts from wastes are expected from the No Action Alternative because all wastes from the existing operations are being handled according to local, state, or federal regulations. An indirect impact would occur in that solid, non-hazardous wastes would not contribute to the filling of county landfills at a rate any different than at present.

Potential Mitigation and Monitoring

No additional mitigation or monitoring measures are proposed beyond those currently being implemented by Newmont.

Irreversible and Irretrievable Commitment or Resources

No irreversible or irretrievable commitment of resources would occur as a result of the waste generating and handling procedures that are an integral part of the Proposed Action or alternatives.

Residual Effects

There would be no residual impacts from wastes generated by the Proposed Action or alternatives, with the exception of the indirect impact to county landfills.

ENVIRONMENTAL JUSTICE

The Proposed Action and alternatives do not have any potential for infractions of the Executive Order directing agencies to address Environmental Justice. This is because the project is in an area removed from any population centers or concentrations of any minority or low income persons, and secondly, it is an expansion of a currently permitted facility in a mining region and does not propose the location of new facilities that would affect persons in their residential communities.

COMPARISON OF IMPACTS

Table 4-7 summarizes and compares impacts between the Proposed Action and the alternatives, including the No Action Alternative. The Agency Preferred Alternative has been identified as Alternative 1, Proposed Action with Backfilling of the Mac pit. Detailed descriptions of impacts are contained in previous sections of Chapter 4. Under the No Action Alternative, existing mining operations would continue through 2001 as approved by the BLM (1993) and associated impacts of these actions constitute existing conditions to assess SOAPA.

Table 4-7 can also be used to compare impacts predicted in 1993 with the predicted impacts of the proposed amendment. Impacts predicted in 1993 are presented under the No Action column, as those impacts either have, or would be expected, to occur by 2001. The text of this EIS mentions certain exceptions where impacts from 1993 have not materialized.

TABLE 4-7
COMPARISON OF IMPACTS BETWEEN THE PROPOSED ACTION AND ALTERNATIVES

		Alternatives		
Resource	**Impacts of Proposed Action**	**Alternative 1 Proposed Action w/Backfilling the Mac Pit**	**Alternative 2 Proposed Action w/Modified WRDFs**	**No Action**
Geology and Minerals	Relocation of approximately 526 million tons of rock material. 330 acres of steep slopes would remain. An area identified as susceptible to sinkhole development occurs within the predicted 10-foot drawdown contour.	Elimination of access to ore resources in the Mac pit. Slightly smaller (6 acres) WRDFs.	Similar to Proposed Action but with slightly smaller (53 acres)but taller (50 feet) WRDFs.	Loss of recovery of several million ounces of gold reserves. Approximately 526 million tons of ore and waste rock not removed. An area identified as susceptible to sinkhole development occurs within the 10-foot drawdown contour.
Paleontology	Impacts limited to area of disturbance.	Similar to Proposed Action.	Similar to Proposed Action.	No potential effects to paleontological resources.
Air Resources	Air quality would remain at or near present levels in the South Operations Area through 2011with short-term increases in particulates.	Additional diesel and fugitive dust emissions would be generated by increased haul distance.	Similar to Proposed Action.	Air quality would begin to return to pre-mining levels after 2001.
Water Resources - Surface Water Quality	No major impacts to surface water quality. Is potential for increased levels of metals and trace elements in discharge waters.	Similar to Proposed Action.	Similar to Proposed Action.	Existing conditions maintained through 2001.

TABLE 4-7 (continued)
COMPARISON OF IMPACTS BETWEEN THE PROPOSED ACTION AND ALTERNATIVES

		Alternatives		
Resource	**Impacts of Proposed Action**	**Alternative 1 Proposed Action w/Backfilling the Mac Pit**	**Alternative 2 Proposed Action w/Modified WRDFs**	**No Action**
Water Resources - (cont.) Surface Water Quantity	Increased baseflow in lower Maggie Creek and Humboldt River during dewatering and reduced baseflow during post-discharge period. Two additional streams could have sections of reduced or eliminated baseflows. The predicted 10 ft drawdown contour would comprise an additional 26,100 acres. Effects continue until 2011.	Similar to Proposed Action.	Similar to Proposed Action.	Eight streams could have sections of reduced or eliminated baseflow. The predicted 10-ft drawdown contour would comprise 151,600 acres. Effects continue until 2001.
Water Resources (cont.) Groundwater Quality	Generally similar groundwater quality in and near Gold Quarry pit after dewatering ceases. Groundwater quality would remain acceptable with water quality standards.	Similar to Proposed Action.	Similar to Proposed Action.	Existing conditions maintained through 2001.
Water Resources - Groundwater Quantity	Lowered water table; reduced groundwater outflow rates during and after dewatering. 11 wells and groundwater rights predicted to be impacted. Groundwater recovery to start in 2011.	Similar to Proposed Action.	Similar to Proposed Action.	Lowered groundwater levels from current operation. 16 wells predicted to be impacted. Groundwater recovery to start in 2001.

TABLE 4-7 (continued)
COMPARISON OF IMPACTS BETWEEN THE PROPOSED ACTION AND ALTERNATIVES

		Alternatives		
Resource	**Impacts of Proposed Action**	**Alternative 1 Proposed Action w/Backfilling the Mac Pit**	**Alternative 2 Proposed Action w/Modified WRDFs**	**No Action**
Springs and Seeps	Reduced or lost flow in five developed and an unindentified number of undeveloped springs and seeps in the project area.	Similar to Proposed Action.	Similar to Proposed Action.	Impacts to 25 springs and seeps from current operations. All 25 had specific mitigation measures proposed. All springs were fenced and water systems installed. See Appendix A.
Surface Water Rights	12 certificated rights potentially affected by lost baseflows.	Similar to Proposed Action	Similar to Proposed Action	Seven certificated rights potentially affected from current operations.
Floodplains	No detectable effect on Humboldt River floodplain.	Similar to Proposed Action.	Similar to Proposed Action.	Existing conditions maintained through 2001.
Soils	Soils disturbed on 1,392 acres. Topsoil spread on 1,253 acres during reclamation.	Soil disturbed on 1,386 acres. Topsoil spread on 1,247 acres.	Soils disturbed on 1,339 acres. Topsoil spread on 1,200 acres.	Existing conditions maintained through 2001. 7,960 acres disturbed and 6,941 reclaimed.
Vegetation	Removal of 1,392 acres. Revegetation of 1,253 acres.	Removal of 1,386 acres. Revegetation of 1,247 acres.	Removal of 1,339 acres. Revegetation of 1,198 acres during reclamation.	Existing conditions maintained through 2001. 1,573 acres disturbed and 1,376 reclaimed.
Noxious Weeds	Disturbance of 1,392 acres provides invasion sites followed by construction. New construction to remove approximately 45 acres of existing infestation.	Similar to Proposed Action. Disturbance of 1,386 acres.	Similar to Proposed Action. Disturbance of 1,339 acres.	Existing infestations subject to ongoing control methods.

TABLE 4-7 (continued)
COMPARISON OF IMPACTS BETWEEN THE PROPOSED ACTION AND ALTERNATIVES

		Alternatives		
Resource	**Impacts of Proposed Action**	**Alternative 1 Proposed Action w/Backfilling the Mac Pit**	**Alternative 2 Proposed Action w/Modified WRDFs**	**No Action**
Riparian Areas and Wetlands	Disturbance of 0.98 acres of Waters of the U.S. in Section 18. A limited amount of riparian areas along Maggie Creek, tributaries, and Humboldt River could be affected. Loss of less than 2.5 acres of riparian habitat associated with springs and seeps.	Similar to Proposed Action.	Similar to Proposed Action.	Impacts on 1,264 acres of riparian habitat from current operations.
Terrestrial Wildlife	Loss of habitat associated with disturbance of 1,392 acres; reduction or loss of flow in springs and seeps would displace wildlife to adjacent areas. Reclamation would restore habitat on 1,253 acres.	Similar to Proposed Action. Disturbance of 1,386 acres. Additional 40 acres at Mac pit available for wildlife; Total 1,247 acres revegetated.	Similar to Proposed Action. Disturbance of 1,337 acres of wildlife habitat. Total of 1,200 acres revegetated.	Existing conditions maintained through 2001. Similar to Proposed Action, Loss of habitat on 7,960 acres, through 2001. Reclamation on 6,941 acres,
Aquatic Habitat and Fisheries	Potential decreased baseflow in two streams during and after dewatering. Potential increase in total loading of metals and trace elements in waters.	Similar to Proposed Action.	Similar to Proposed Action.	Potential reduction or lost baseflow in 8 streams during and after dewatering. Existing conditions maintained through 2001. Potential increase in total loading of metals and trace elements.

TABLE 4-7 (continued)
COMPARISON OF IMPACTS BETWEEN THE PROPOSED ACTION AND ALTERNATIVES

		Alternatives		
Resource	**Impacts of Proposed Action**	**Alternative 1 Proposed Action w/Backfilling the Mac Pit**	**Alternative 2 Proposed Action w/Modified WRDFs**	**No Action**
Threatened, Endangered, Candidate and BLM Sensitive Species	Lahontan cutthroat trout habitat would not be affected by temporary reductions in baseflow resulting from the continued dewatering program beyond those already occurring. Bald eagle may be exposed to increased levels of metals and trace elements in aquatic prey.	Similar to Proposed Action.	Similar to Proposed Action.	Lahontan cutthroat trout habitat would be affected by temporary reductions in baseflow in portions of Maggie Creek and potential habitat in Susie Creek resulting from the currently approved dewatering program. Springsnails potentially affected in 1 spring.
Livestock Grazing	A total of 71 AUMs would be displaced on public lands as a result of surface disturbance for the life of the project and reclamation. Reclamation and recovery of the water table would reestablish most grazing habitat.	Reclamation of Mac pit would add 40 acres livestock grazing (2 AUMs).	Similar to Proposed Action.	Existing conditions maintained through 2001. 8,092 AUMs temporarily displaced.
Recreation	Continued visitation stress on existing recreational facilities in the Elko area.	Similar to Proposed Action.	Similar to Proposed Action.	Cessation of mining in 2001 and a population decrease could reduce visitation on existing recreational facilities in the Elko area.
Visual Resources	Expansion would not create major visual impacts relative to existing facilities.	Similar to Proposed Action.	Similar to Proposed Action.	Existing conditions (large scale modifications to land forms and visible cooling tower plumes) maintained through 2001.
Noise	No change to existing noise levels	Similar to Proposed Action	Similar to Proposed Action.	Existing conditions maintained through 2001

TABLE 4-7 (continue)
COMPARISON OF IMPACTS BETWEEN THE PROPOSED ACTION AND ALTERNATIVES

		Alternatives		
Resource	**Impacts of Proposed Action**	**Alternative 1 Proposed Action w/Backfilling the Mac Pit**	**Alternative 2 Proposed Action w/Modified WRDFs**	**No Action**
Land Use and Access	Minor modification to land use and access would result.	Similar to Proposed Action.	Similar to Proposed Action.	Existing restrictions maintained until reclamation is complete.
Cultural Resources and Ethnography	No direct impacts to cultural resources. Dewatering may potentially affect traditional values or practices of the Western Shoshone.	Similar to Proposed Action.	Similar to Proposed Action.	Existing conditions (disturbance of 37 cultural resources, three of which are NRHP eligible) maintained through 2001.
Social and Economic Resources	No temporary impacts during the construction period on community services. State and local economic benefits from taxes and commercial activities.	Similar to Proposed Action.	Similar to Proposed Action.	Termination of mining at end of 2001; majority of work force laid-off. Reduction in local economic benefits from taxes.
Wastes - Solid or Hazardous	No significant change in magnitude of waste generation. Waste generation would continue until 2011.	Similar to Proposed Action.	Similar to Proposed Action.	Existing approved waste management practices would continue through 2001.
Environmental Justice	No impacts would occur.	Similar to Proposed Action.	Similar to Proposed Action.	No impacts are occurring.

CHAPTER 5
CUMULATIVE EFFECTS ANALYSIS

CHAPTER 5

CUMULATIVE EFFECTS ANALYSIS

This chapter summarizes the anticipated cumulative effects, both direct and indirect, of implementation of the SOAPA project together with other past, existing, and reasonably foreseeable projects in the Carlin Trend vicinity. These cumulative effects would result from incremental effects of the Proposed Action when added to the effects from other activities along the Carlin Trend.

The cumulative effects analysis was assembled from two evaluations. The first analysis for geology; water resources and geochemistry; wetlands; riparian vegetation; terrestrial wildlife; aquatic resources; threatened, endangered, candidate, and sensitive species; grazing management; socioeconomics; and Native American religious concerns was based on the effects of dewatering and water discharge from mining operations in the Carlin Trend. The BLM document (BLM, 2000b) is a technical report entitled Cumulative Impact Analysis of Dewatering Operations for Betze Project, SOAPA, and Leeville Project. The discussion in this chapter represents summaries of the technical analyses for the above-listed resources.

The second analysis for paleontological resources, air resources, upland vegetation, floodplains, soils, noxious weeds, recreation, visuals, noise, land use/access, waste management, and environmental justice was based on the potential effects of non-dewatering impacts as a result of mining in the Carlin Trend.

The potential cumulative effects of the alternatives to the Proposed Action were not analyzed for two reasons: (1) a review of **Table 4-7** indicates that potential effects from the SOAPA alternatives are not greatly different from the Proposed Action, and (2) analyzing cumulative effects from SOAPA alternatives might suggest that alternatives at the other 30 projects discussed might also have alternatives with different levels of impact that should be analyzed. However, this was considered beyond the scope of the cumulative analyses.

EXISTING AND FORESEEABLE PROJECTS

Figure 5-1, and Tables 5-1 and 5-2 present the existing and reasonably foreseeable projects and related disturbance by mining on the Carlin Trend. This information forms the basis for discussion of cumulative effects for this chapter.

IMPACTS SUMMARY

Geology

Karst Development in the Region

The primary issue identified for this assessment of cumulative geological impacts is the potential for development of sinkholes or other karst-type collapse features that could result from mine-induced drawdown and water management activities. Three

sinkholes have been documented to date in the area since dewatering operations were initiated at the Goldstrike and Gold Quarry mines: (1) a sinkhole approximately 3.5 miles northwest of the center of the Betze-Post pit; (2) a sinkhole approximately 2.8 miles west of the center of the Betze-Post pit located near spring 6; and (3) a sinkhole along Maggie Creek in an area referred to as the Maggie Creek Canyon.

Areas Susceptible to Future Sinkhole Development

Available information on the geology in the region and prediction of mine-induced ground water drawdown were used to identify areas potentially susceptible to future sinkhole development. These areas include (1) various locations within a large area underlain by carbonate rock located between the Betze-Post and Gold Quarry pits; (2) an area northwest of the Betze-Post pit; (3) an area along Maggie Creek located north of the Gold Quarry pit; and (4) an area located west of the Gold Quarry pit. The development of sinkholes can pose a hazard to livestock, humans, wildlife, and facilities (such as buildings, roads, and other structures).

Impacts to the Humboldt River

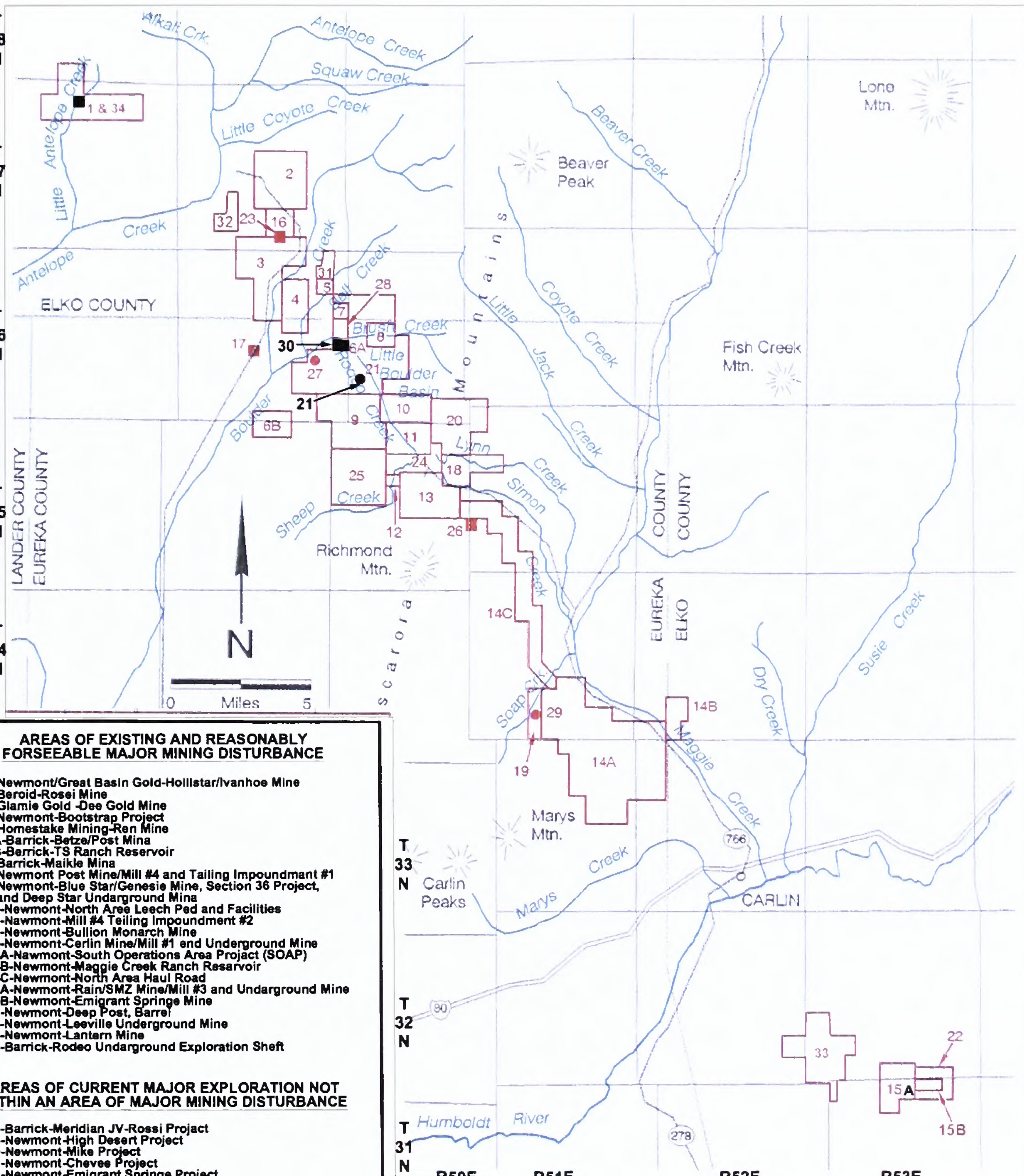
No geological impacts are anticipated to the Humboldt River study area as a result of increased or decreased river flows or dewatering.

Paleontological Resources

Vertebrate fossils occur primarily in Tertiary- and Quaternary-age sediments, whereas invertebrate fossils are more common in Paleozoic-age sedimentary rocks. Because of the greater abundance of vertebrate fossils, open pit mining intercepting Tertiary-age sediments would have the greatest potential for impacting paleontological resources. Other mining related surface activities are shallow and would primarily affect unconsolidated soil surfaces. As a result, cumulative effects on paleontological resources in the region are not expected to be significant. Mining may also expose fossils that may be used for research to further the knowledge of resources in the area.

Air Resources

There may be some regional elevation of particulates through 2011 resulting from short-term construction activities and mining operations. As various mines cease operations, other mines may begin operations over the next few years, so PM_{10} levels would be variable. Mining activities generally produce levels of emissions of carbon monoxide, nitrogen dioxide, sulfur dioxide or ozone that are well below the regulatory allowable levels. Cumulatively, mining emissions would have minimal effect because of project separation distances, meterological conditions that promote good dispersion, and the fact that not all projects would produce emissions concurrently. With cessation of mining and completion of reclamation activities, air quality would be expected to return to pre-mining conditions.



AREAS OF EXISTING AND REASONABLY FORSEEABLE MAJOR MINING DISTURBANCE

1-Newmont/Great Basin Gold-Hollistar/Ivanhoe Mine
2-Beroid-Rosei Mine
3-Glamie Gold -Dee Gold Mine
4-Newmont-Bootstrap Project
5-Homestake Mining-Ren Mine
6A-Barrick-Betze/Post Mina
6B-Berrick-TS Ranch Reservoir
7-Barrick-Maikle Mina
8-Newmont Post Mine/Mill #4 and Tailing Impoundmant #1
9-Newmont-Blue Star/Genesie Mine, Section 36 Project, and Deep Star Underground Mina
10-Newmont-North Area Leech Ped and Facilities
11-Nawmont-Mill #4 Teiling Impoundment #2
12-Newmont-Bullion Monarch Mine
13-Newmont-Cerlin Mine/Mill #1 end Underground Mine
14A-Nawmont-South Operations Area Project (SOAP)
14B-Newmont-Maggie Creek Ranch Resarvoir
14C-Newmont-North Area Haul Road
15A-Newmont-Rain/SMZ Mine/Mill #3 and Undarground Mine
15B-Newmont-Emigrant Springe Mine
21-Newmont-Deep Post, Barrel
24-Newmont-Leeville Underground Mine
25-Newmont-Lantern Mine
28-Barrick-Rodeo Undarground Exploration Sheft

AREAS OF CURRENT MAJOR EXPLORATION NOT WITHIN AN AREA OF MAJOR MINING DISTURBANCE

16-Barrick-Meridian JV-Rossi Project
18-Newmont-High Desert Project
19-Newmont-Mike Project
20-Newmont-Chevee Project
22-Newmont-Emigrant Springe Project
31-Cameco US Inc.-Ren Project
32-Trio Gold Corp-Rodeo Creek Project
33-Newmont-Woodruff Creek Project
34-Great Basin Gold-Ivanhoe Exploration
3-Berrick-Dee Exploration
21-Berrick-Betze Exploration
23-Barrick-Storm Exploration Decline Project (underground exploration eeme aree es #23)

AREAS OF REASONABLY FORSEEABLE MINE DEVELOPMENTS ■

17-North Area Bioleach Facility
23-Maridian Gold Rossi (Storm) Deposit
26-Nawmont-Pete Deposit
1&34-Great Basin Gold-Ivenhoe Underground Mine
30-Barrick-Goldbug Underground Mina

LOCATIONS OF KNOWN UNDEVELOPED GOLD DEPOSITS ●

21-Newmont-Deep Post, Goldbug, Barrel
27-Berrick-Screamer
29-Newmont-Mike

SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 5-1
MINING ACTIVITY
IN THE CARLIN TREND

MINE AREA: SOUTH AREA	
DATE: 4/1/00	ACAD FILE: Fig5-1.DWG
SCALE: AS NOTED	DRAWN BY: EC, MODIFIED BY EG

TABLE 5-1 EXISTING AND REASONABLY FORESEEABLE MINING DISTURBANCE IN THE CARLIN TREND						
Map Reference Number	Facility Name	Existing[1] and Reasonably Foreseeable Mining Disturbance (Acres)				Comments and Source of Acreage Information
		Pre-1981	1981-1999	1999-2016	Total	
1	Newmont/Great Basin Gold - Hollister/Ivanhoe Mine	0	268	0	268	Mine currently undergoing closure and reclamation. Plan of Operations N16-87-002P/Ivanhoe underground is foreseeable action
2	Baroid - Rossi Mine	100	183	280	563	Active barite mine, currently under exploration for gold. (POO N16-81-003P) Expansion of the Mine is a forseeable action
3	Glamis Gold Ltd. - Dee Gold Mine	0	802	830	1,632	Active gold mine (POO-N16-83-005P)
4	Newmont - Bootstrap Project	234	0	1,118	1,352	Active gold mine (POO N16-94-002P) Bootstrap EIS (BLM, 1996)
5	Homestake Mining Co. - Ren Mine	0	62	0	62	Inactive gold mine and heap leach facility; closure and reclamation in progress. (POO-N16-88-005P)
6A	Barrick - Betze/Post Mine	0	6,758	2,615	9,373	Active gold mine with dewatering (POO-N16-88-002P)
6B	Barrick - TS Ranch Reservoir	0	494	0	494	Catchment reservoir for water discharge from Betze/Post Mine (POO-N16-88-002P)
7	Barrick - Meikle Mine	0	92	0	92	Underground gold mine with dewatering. (POO-N16-92-002P)
8	Newmont - Post/Mill #4 and Tailing Impoundment #1	0	884	0	884	Existing mill and tailing facility. (POO N16-88-008P)
9	Newmont - Blue Star/Genesis Mine, Section 36 Project and Deep Star underground mine	200	1,290	1,022	2,512	Active gold mines. (POO N16-88-007P)
10	Newmont - North Area Leach Facility	0	494	169	663	Existing leach pad facility (POO N16-88-007P)
11	Newmont - Mill #4 Tailing Impoundment #2	0	280	15	295	Existing tailing facility(POO N16-88-008P)
12	Newmont - Bullion Monarch Mine (formerly Universal Gas)	50	0	0	50	Inactive mine, mill and tailing facility; closure and reclamation in progress. (Notice N16-81-013N)
13	Newmont - Carlin Mine/ Mill #1 and Underground Mine	0	1,598	0	1,598	Active gold mine. Expansion (Pete project) permitting in progress (POO N16-81-010P)
14A	Newmont - South Operations Area Project	0	7,960	1,320	9,280	Active gold mine: Expansion permitting in Progress (POO N16-81-009P)
14B	Maggie Creek Ranch Reservoir	0	300	0	300	Catchment reservoir for discharge water from Gold Quarry Mine (POO N16-81-009P)
14C	North Area Haul Road	0	189	0	189	Haulroad between Gold Quarry and Carlin Mines (POO N16-81-009P)

TABLE 5-1 (continued) EXISTING AND REASONABLY FORESEEABLE MINING DISTURBANCE IN THE CARLIN TREND						
Map Reference Number	Facility Name	Existing[1] and Reasonably Foreseeable Mining Disturbance (Acres)				Comments and Source of Acreage Information
		Pre-1981	1981-1999	1999-2016	Total	
15A	Newmont - Rain and SMZ Mine/Mill #3 and Underground Mine	0	954	7	961	Active gold mine (POO N16-86-007P) Expansion Permitting in Progress (Emigrant Springs)
15B	Newmont - Emigrant Springs Mine Project	0	0	418[2]	418	Proposed open pit gold mine; permtting in progress: Expansion of Rain Mine Project (POO N16-86-007P)
17	North Area Bioleach Facility	0	0	600[2]	600 [2]	Foreseeable gold leach facility and operation. (Newmont)
24	Newmont - Leeville Mine	0	0	496 [2]	496 [2]	Proposed underground mine and facilities (POO N16-97-004P)
25	Newmont - Lantern Mine	0	235	394 [2]	629	Open pit gold mine and foreseeable expansion. (POO N16-88-007P)
26	Newmont - Pete Project	0	0	1,666 [2]	1,666 [2]	Proposed open pit gold mine and leach operation. Expansion of Carlin Mine (POO N16-81-010P)
34	Great Basin Gold - Ivanhoe Underground Mine	0	0	100[2]	100 [2]	Foreseeable underground gold mine and facilities (Stadelman)
TOTAL DISTURBANCE ACRES		584	22,893	11,050	34,477	

[1]Projects permitted by BLM as of 2/4/00.
[2]Acreages for reasonably foreseeable disturbances (1999-2011) are estimates subject to change upon submittal of the actual propsal.
POO - Plan of Operations
Note: Exploration projects are shown in **Figure 5-1** that total 1,397 acres; Newmont Chevas (POO N16-93-002P) = 168 acres; Newmont Mike (POO N16-92-004P) = 48 acres; Newmont High Desert (POO N16-92-003P) = 164 acres; Newmont Emigrant Springs (POO N16-93-001P) = 63 acres; Barrick-Meridian JV Rossi (POO N16-90-002P) = 51 acres; Newmont Woodruf Creek (POO N16-96-002P) = 66 acres; Cameco (US) Ren (POO N16-97-003P) = 30 acres; Trio Gold Rodeo Creek (POO N16-97-002P) = 42 acres; Newmont Carlin (POO N16-81-002P) = 255 acres; Great Basin Gold Ivanhoe (POO N16-93-003P) = 15 acres; Barrick Dee (POO N16-98-001P) = 19 acres; Barrick Goldstrike (POO N16-98-002P) = 233 acres; Barrick Storm Decline (POO N16-99-001P) = 10 acres; Barrick Rodeo/Goldbug Underground Shaft (private land) = 50 acres; Barrick-Betze Exploration (N16-98-002P) = 213 acres.

TABLE 5-2
EXISTING AND REASONABLY FORESEEABLE MINING DISTURBANCE IN THE CARLIN TREND FROM OPEN-PITS ONLY

Map Reference Number	Facility Name	Existing[1] and Reasonably Foreseeable Mining Disturbance for Open-Pits Only (Acres)				Comments and Source of Acreage Information
		Pre-1981	1981-1999	1999-2011	Total	
1	Newmont Great Basin Gold - Hollister Mine	0	54	0	54	Open pit gold mine currently undergoing closure and reclamation (POO N16-87-002P)
2	Baroid - Rossi Mine	0	80	100 [2]	180	Active open pit barite mine, currently under exploration for gold (POO N16-81-003P) Expansion of the pit is a foreseeable future action
3	Glamis Gold - Dee Gold Mine	0	136	248	384	Active gold mine (POO N16-83-005P)
4	Newmont - Bootstrap Project	59	0	217	276	Active gold mine (POO N16-94-002P)
5	Homestake Mining Co. - Ren Mine	0	5	0	5	Inactive open pit mine and heap leach facility; closure and reclamation in progress. (POO N16-88-005P)
6A	Barrick - Betze/Post Mine	0	1,412	0	1,412	Active open pit gold mine with dewatering (POO N16-88-002P)
9	Newmont - Blue Star/Genesis Mine and Section 36 Project and underground mine	50	506	420	976	Active open-pit and underground (adit) gold mines (POO N16-88-007P)
12	Newmont - Bullion Monarch Mine (formerly Universal Gas)	6	0	0	6	Inactive open pit gold mine, mill and tailing facility; closure and reclamation in progress (Notice N16-81-013N)
13	Newmont - Carlin Mine/Mill #1 and underground mine	100	226	0	326	Active open pit and underground (adit) gold mines (POO N16-81-010P). Expansion (Pete Project) permitting in progress
14A	Newmont - South Operations Area Project (SOAP)	0	815	1158	1,973	Active open pit gold mine (POO N16-81-009P)
15A	Newmont - Rain, SMZ, and Underground Mines	0	165	7	172	Active open pit and underground (adit) gold mines (POO N16-86-007P), expansion (Emigrant Springs Project) permitting in progress
15B	Newmont - Emigrant Springs Mine	0	0	123	123	Proposed open pit gold mining operation. Permitting in progress; expansion at Rain Mine Project (POO N16-87-006P)
25	Newmont - Lantern Mine	0	53	47 [2]	100	Active open pit gold mine and foreseeable mine expansion. (Newmont)
26	Newmont - Pete Mine	0	0	487	487	Proposed open pit gold mine; permitting in progress; expansion at Carlin Mine (POO N16-81-010P)
TOTAL DISTURBANCE ACRES FROM OPEN PITS ONLY/		215	3,452	2,807	6,474	

[1]Projects permitted by BLM as of 2/4/00.
[2]Acreages for reasonably foreseeable disturbances (1999-2017) are estimates subject to change upon submittal of the actual propsoal.
POO - Plan of Operations.

Water Resources and Geochemistry

Based on past and planned future dewatering activities, and the ground water modeling conducted for the Goldstrike, Gold Quarry, and proposed Leeville mines, these operations would have cumulative ground water and surface water impacts associated with ground water drawdown and mounding. Four mining operations have been identified with the potential for cumulative impacts associated with discharges to the Humboldt River; these include the Goldstrike Mine, Gold Quarry Mine, Lone Tree Mine, and the proposed Leeville Mine.

Impacts from Mine Dewatering and Localized Water Management Activities

Impacts to Date

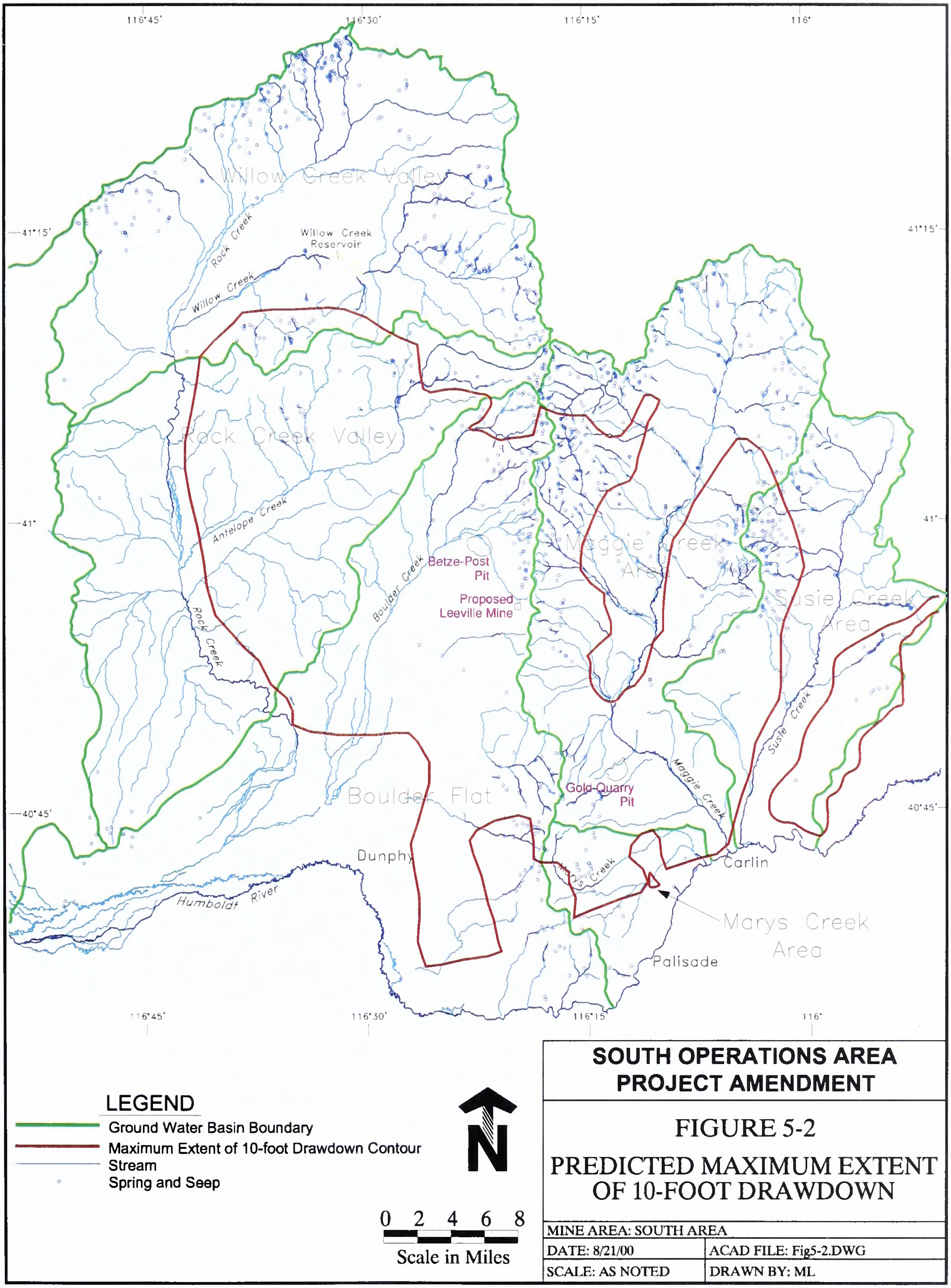
As of the end of 1998, over 1,500 feet of drawdown had occurred to date in the vicinity of the Goldstrike Mine, and over 600 feet of drawdown had occurred in the vicinity of the Gold Quarry Mine as a result of mine dewatering. In the vicinity of the proposed Leeville Mine, 350 feet of drawdown had occurred from existing dewatering operations at other mines. Groundwater cones of depression have formed around the Goldstrike and Gold Quarry mines; both cones of depression exhibit a northwest-southeast elongation and apparently merge together beneath the Tuscarora Mountains southeast of the Carlin Mine.

Infiltration of excess mine water from the dewatering operations has resulted in an increase in water levels, or mounding, in the upper Boulder Valley and lower Maggie Creek areas. As of the end of 1998, water levels in the Boulder Valley region had risen up to approximately 70 feet in the rhyolite in the Sheep Creek Range and 50 feet in the alluvium in upper Boulder Valley. Seepage from Maggie Creek Reservoir and through infiltration along portions of lower Maggie Creek has resulted in an increase in water levels up to 45 feet in the shallow Carlin Formation aquifer.

Near the Goldstrike Mine, several springs located both within and outside of the current 10-foot drawdown area have dried up or shown a reduction in flow, and some of these effects may be related to mine dewatering. The flow and vegetation in Brush Creek, a tributary to Rodeo Creek, have changed substantially since 1993, indicating that this drainage has been impacted by mine dewatering. No other stream impacts have been identified on the western side of the Tuscarora Mountains. In addition, no significant effects on monitored spring flows have been identified on the eastern side of the Tuscarora Mountains or in the vicinity of the Gold Quarry Mine.

Predicted Impacts to Springs and Seeps and Stream Baseflow

Numerical models were used to predict groundwater drawdown over time resulting from the cumulative mine dewatering **(Figure 5-2)**. There are approximately 497 springs and seeps identified within the predicted cumulative 10-foot drawdown area. Hydrogeologic conditions, spring and seep surveys, elevations, and geochemistry for representative springs indicate that 195 of



SOUTH OPERATIONS AREA PROJECT AMENDMENT

FIGURE 5-2

PREDICTED MAXIMUM EXTENT OF 10-FOOT DRAWDOWN

MINE AREA: SOUTH AREA	
DATE: 8/21/00	ACAD FILE: Fig5-2.DWG
SCALE: AS NOTED	DRAWN BY: ML

these spring and seeps are located in areas where perennial surface waters would potentially be impacted by drawdown.

Base flows in some stream reaches would potentially be reduced as a result of the mine-induced drawdown from the Goldstrike, Leeville, and Gold Quarry mine operations. Drawdown could impact flows in lower Maggie Creek, lower Marys Creek (and adjacent areas, including the Carlin Cold Springs, and Carlin Hot Springs), lower Susie Creek, Rock Creek, and Boulder Creek; the actual magnitude and extent of impacts to perennial streams is uncertain.

The results of the modeling indicate that water levels in 147 water supply wells would potentially be lowered by at least 10 feet during the mine life or in the post-mining period as a result of drawdown from the Goldstrike, Leeville, and Gold Quarry mines. Lowering the water levels in these wells would potentially reduce yield, increase pumping cost, or if the water level were lowered below the pump setting or below the bottom of the wells, the well would become unuseable.

Predicted Baseflow Reductions

A potential reduction in the baseflow of perennial springs and streams could affect surface water rights within the drawdown area. There are 44 surface water rights located within the potential drawdown area. Twenty-eight of these water rights are used either for irrigation or stock watering, and 16 are used for domestic, mining and milling, municipal, or other uses. The actual potential for impacts to individual water rights would depend on the site-specific hydrologic conditions that control surface water discharge.

Impacts to the Humboldt River

Mine discharges were initiated in 1992 and increased between 1992 and 1998. The Lone Tree Mine began discharging treated water to the Humboldt River in 1992; the Gold Quarry Mine began discharging to Maggie Creek near Carlin, Nevada, in 1994, and the Goldstrike Mine discharged water to the Humboldt River from September 1997 to February 1999. In addition, the proposed Leeville Mine is anticipated to discharge to the river through the existing Goldstrike Mine water conveyance system beginning in the year 2002. Peak cumulative discharges are projected to occur from 1999 through 2006 and would continue at a substantially lower rate from 2006 through 2012.

Comparison of monthly flows at the gages during the pre-mining discharge period (1946 to 1990) with flows during the current mining discharge period (1991 to 1998) indicate that for all months except January 1997 at Battle Mountain, the range of flows recorded during the current discharge period are within the range of flows recorded historically (1946 to 1990). Flows in January 1997 at Battle Mountain were greater than recorded during the pre-mining discharge period; however, mine discharge for this period represents only 3 percent of the flow.

By comparing streamflows resulting from the Proposed Action with those that occurred between 1946 and 1990, the discussion disregards many past cumulative effects on flows in the river from agricultural diversions and the Bureau of Reclamation's projects in

particular. For example, Rye Patch dam was constructed in 1936 and other diversions for agriculture likely occurred by the late 1800s. These activities have had a major effect on the biota of the river.

Modeling of projected future discharges indicates that compared to the average pre-mining conditions, the largest percentage increase in flow would occur in the lower flow months (late summer and fall months) and relatively minor changes in flow are anticipated during the peak flow months (spring to early summer). Simulation of changes to flow during the low-flow year indicate that there is a large relative change to the average monthly flows for the low-flow late summer and fall months at both the Battle Mountain and Comus gages under the maximum discharge scenario.

In the post-discharge period, residual drawdown from the mine dewatering operations is predicted to reduce baseflow in the Humboldt River. The baseflow reductions are predicted to reach a maximum around 2016 and gradually recover thereafter to near pre-mining levels. A longterm reduction of baseflow (around 1 cfs) could be an impact to biota in the river, especially during dry years. The predicted baseflow reductions are a small percentage of baseflow on an annual basis but represent a larger percentage of the average river flow in the drier months (late summer and fall).

The increased Humboldt River flows would generally not create additional flooding along the river upstream of Rye Patch Reservoir. The cumulative mine discharges would contribute to the stored volume in Rye Patch Reservoir and may present difficulties during high-flow years in preserving emergency storage and minimizing flooding and structural damages downstream. Effects related to stream erosion, sedimentation, and channel geometry from the cumulative discharges are likely to be small. Significant long-term impacts on surface water rights within the Humboldt River basin are not anticipated.

Mine discharges have generally been within their permit limitations. Provided that all of the mine discharges operate in accordance with their permit limitations, cumulative impacts to water quality in the river are not anticipated. On an average annual basis, the mine discharges represent a major loading increase in TDS, arsenic, boron, fluoride, copper, and zinc compared with pre-mine discharge conditions. The cumulative annual average loads from the mine discharges would likely increase TDS, arsenic, boron, and fluoride loads in the Humboldt Sink over the mine discharge period. Those predicted average annual increases are: total dissolved solids - 15 percent, up to approximately 7.5 million tons; arsenic - 21.6 percent, up to approximately 360 tons; boron - 14.6 percent, up to approximately 8,600 tons; and fluoride - 66 percent, up to approximately 10,800 tons (BLM, 2000b). Depending on concentrations in the Humboldt Sink, parameter solubilities and other physical and biological factors, these increased loads to the sink could potentially result in increased concentrations in the sink wetlands (BLM, 2000b).

Floodplains

Predicted Dewatering Effects

As many as 60 miles of stream channels could be indirectly affected by dewatering by proposed and reasonably foreseeable mining projects. Indirect effects could include reducing baseflow or reducing springs and seeps that contribute to surface flow. There would be differences in 100-year floodplain width both from discharge water being added to normal flow, and conversely in Susie Creek, where reductions in baseflow would only leave the runoff component in a 100-year storm event, making the floodplain width narrower. Wherever dewatering would reduce baseflows, the floodplain vegetation would likely become more upland in nature. If riparian vegetation is lost in lower Susie Creek, the vegetation that replaces it probably would not be able to withstand large flow events without increased erosion.

Impacts to the Humboldt River

Flow increases in the Humboldt River resulting from mine discharges would be well within the active channel for low and moderate flows, and would be undetectable during high flows. As discussed in Chapter 4, it is expected that mine discharge-induced flow increases would have no detectable effect on the Humboldt River floodplain width.

Soils

Over 34,000 acres of soils are predicted to be disturbed by 2011 (**Table 5-1**), but much of that disturbance would be short-term. After reclamation is complete, approximately 6,474 acres would remain with long-term disturbance (open pits) (**Table 5-2**). Even when soils are replaced and revegetated, there would be a long-term loss of soil productivity. Overall, cumulative effects on the soil resource are anticipated to be moderate (18.7 percent residual disturbance).

Vegetation

The known and reasonably foreseeable projects along the Carlin Trend are expected to disturb over 34,000 acres of vegetation by 2011. Disturbance would include loss or reduction of vigor of vegetation due to groundwater drawdown and loss or reduction of surface water sources. All communities would experience these effects whether native or introduced. Physically disturbed areas would be reclaimed according to various reclamation plans and with various seed mixtures, fertilizers and amendments. Disturbed or stressed native communities that were not physically disturbed would not have the benefits of any such amendments and would be expected to recover naturally as the source of the stress was removed. Direct effects would largely be short-term, and reclamation and revegetation would reclaim all but 6,474 acres. Revegetation success is determined as 100 percent cover compared with undisturbed reference areas.

Noxious Weeds

Noxious weeds are spread by vehicles, livestock, wildlife, wind, and water transport of seeds. Each of the more than 30 proposed or reasonably foreseeable projects would maintains a fleet of its own mining vehicles, plus each project would have employee

vehicles traveling to and from the site. This level of vehicular travel would contribute greatly to seed dispersal. The cumulative list of projects would disturb over 34,000 acres and disturbed soils are primary invasion sites for noxious weeds. Disturbed soils are also prone to erosion by water and can further promote seed dispersal. Some projects may offer benefits from the control of noxious weeds by physically removing infestations as part of their site development activities. The potential for invasion and the potential for weed removals cannot be quantified, as current levels of weed infestation are not known for each site, and seed dispersal would be variable from site to site.

Wetlands and Riparian Areas

Predicted Dewatering Effects

Approximately 600 acres (14 percent) of the 4,355 acres of riparian vegetation within the cumulative assessment area occur within the areas where perennial waters could be affected by groundwater drawdown. The remaining 3,755 acres of riparian vegetation within the cumulative assessment area occur outside of these areas and are considered less likely to be affected by groundwater drawdown. Approximately 18 additional acres of wetland vegetation associated with isolated springs and seeps occur within these areas where perennial waters could be affected. Therefore, the amount of wetland and riparian vegetation in these areas could be reduced. The Maggie Creek Watershed Restoration Program has significantly improved the stream and riparian habitat since 1993. Newmont has also committed to monitoring of springs and providing replacement flows, if necessary, to provide mitigation. The Maggie Creek Watershed Restoration Program was designed to enhance 1,982 acres of riparian habitat, over 40,000 acres of upland watershed, and 82 miles of stream channel in the Maggie Creek basin.

Impacts on the Humboldt River

The increased water levels in the Humboldt River during peak and low baseflows would result in a variety of effects. Riparian/wetland plants would become established in areas where the water table is elevated to the depths needed for riparian/wetland plant establishment. Increases in the extent of riparian vegetation would be most noticeable along segments of the river with gradual banks and low-lying areas located adjacent to the river. An additional impact resulting from increased water levels would be the potential for restoring or enhancing specific wetland and marsh habitats in Herrin Slough (BLM, 2000b). Other effects may include the deepening of the river channel and loss of streamside riparian vegetation resulting in increased erosion and destabilization of stream banks.

Impacts to riparian/wetland vegetation from anticipated flow reductions within the Humboldt River could include an unquantifiable, long-term reduction in extent of riparian vegetation along the river. Riparian vegetation would begin to re-establish to premining levels upon the eventual recovery of the river's baseflows. During the period of discharges, the areal extent of wetland vegetation within the Humboldt Sink would increase as a result of higher and more consistent water levels.

Terrestrial Wildlife

Predicted Dewatering Effects

Mine dewatering could reduce the amount and extent of available surface water and associated riparian habitats within portions of the cumulative study area for a number of terrestrial species. Flows from naturally occurring springs and perennial reaches within the Maggie Creek, Susie Creek, Marys Creek, Boulder Creek, and Rock Creek subbasins may be affected in the long term (i.e., 100 to 170 years after mining). Potential reduction or loss of available water and long-term effects to the riparian community would result in a loss of breeding, foraging and cover habitats; increased animal mortalities; a reduction in overall biological diversity; possible genetic isolation; a reduction in the regional carrying capacity for terrestrial wildlife; and possible long-term impacts to population numbers of some species. The recovery of groundwater and surface water sources would be gradual. Incremental habitat loss would affect big game, upland game birds, waterfowl, shorebirds, raptors, songbirds, nongame mammals (e.g., bats), area reptiles, and amphibians. If the reclamation does not reproduce the original habitat, a net loss to the original wildlife resource would be expected. Depending on the post mining land use, it is also possible to provide a net gain to wildlife if the reclamation is conducted properly.

However, potential exposure risks to avian and mammalian wildlife from potentially elevated metals and trace elements may occur. Exposure possibilities of wildlife to additional tailing impoundments and the weak cyanide solutions contained in them may increase. If additional pit lakes are developed, wildlife exposure to elevated concentrations of metals and trace elements may occur. After additional waste rock disposal facilities, tailing impoundments, and leach pads are closed, potential acid rock drainage may develop with resulting possible contamination of the food chain for wildlife. The temporary disturbance of over 34,000 acres would, inevitable, contain some important wildlife habitat. Reclamation of those disturbed areas would restore a large proportion of those lands to wildlife habitat and use.

Impacts on the Humboldt River

Discharges to the Humboldt River would result in impacts to both resident and migratory wildlife during the mine's discharge period. Overall impacts would include increased water availability for consumption, support of riparian vegetation, and restoration of wetland and marshy habitats along the river corridor, which would provide additional nesting, brooding, foraging, and resting habitat. Increased annual flows may result in more open water during the winter season, consequently improving foraging opportunities. The eventual reduction in the Humboldt River baseflows from cumulative drawdown effects could impact the extent of riparian vegetation along the river. However, this river system has evolved with dynamic water regimes, thereby minimizing the effects to wildlife from reduced baseflows. Past cumulative effects such as dams and agricultural diversions have reduced streamflows significantly over those predicted in this cumulative effects analysis.

Impacts on the Humboldt Sink

Increased flows into the Humboldt Sink would improve breeding, foraging, and resting opportunities for many, but not all resident and migratory wildlife species. Possible exposure risks to avian and mammalian wildlife from metals and other constituents compared with premining conditions would be minimal. However, the dynamic nature of the Humboldt Sink's water system, influence of upstream water demands, fluctuations in water levels, bioaccumulation factors for some metals, and a number of environmental variables (e.g., wind deposition of salts) make it difficult to predict future long-term exposure risks to the biota.

Aquatic Habitat and Fisheries

Predicted Dewatering Effects

Mine dewatering could reduce water levels or flows in some springs and perennial reaches within the Maggie Creek, Susie Creek, Marys Creek, Boulder Creek, and Rock Creek subbasins. The effect of decreased perennial stream flows on aquatic resources would be a reduction of aquatic habitat that supports Lahontan cutthroat trout and other native fish species, periphyton, and macroinvertebrate communities. Water level reductions in springs would affect periphyton, macroinvertebrates, and native fish species (if present). Habitat reductions would likely result in decreased numbers in these communities. If stream segments that do not normally dry out during low flow seasons become dry as a result of reduced flows, aquatic habitat and associated biota would be eliminated. Drawdown would continue to expand and reach a maximum at approximately 100 years during the post-mining period. Afterward, there would be a gradual recovery of the aquifer and most associated surface waters.

Impacts on the Humboldt River

The effects of flow increases on aquatic communities in the Humboldt River would include a variety of impacts. Discharges to the river would result in the effect of increased habitat for fish, macroinvertebrates, and periphyton. However, the possible reduction of shallow pools and braided channels could affect the development of young fish. Increased flows could also result in fish composition changes, as introduced species would be able to disperse and utilize wider areas of the river and likely compete with native species. The effects of increased flows on water quality conditions could involve an increase in the concentrations of metals and trace elements. It is possible that increased sediment levels may affect aquatic biota in a 15-mile section near the Barrick outfall and Comus gage.

Threatened, Endangered, Candidate, and Sensitive Species

Predicted Dewatering Effects

Mine dewatering could adversely affect habitat within the regional hydrologic study area for the following terrestrial wildlife species: Preble's shrew, seven sensitive bat species, sage grouse, bald eagle, ferruginous hawk, northern goshawk, white-ibis, and black tern. The potential reduction in perennial flows or water levels in springs could reduce

the amount of riparian and wetland habitat, which are used by these species for cover, feeding, breeding, or other biological requirements. Mine dewatering may affect the burrowing owl by loss of free water areas. Reduced flows in portions of the Maggie Creek drainage also could affect willow vegetation, which is used by the Nevada viceroy (butterfly) as well as the potential for a meta-population of Lahontan cutthroat trout in the Maggie Creek basin.

The SOAPA would be unlikely to contribute cumulative effects on the white pelican. White pelicans also have a low chance of occurring in the cumulative study area, as they require large bodies of water with islands for breeding, as well as marshes for foraging.

Mine dewatering also could affect habitat for the Lahontan cutthroat trout. Surface flows could be reduced in portions of Little Jack, Coyote, Jack, Beaver, and Maggie Creeks, which are occupied by Lahontan cutthroat trout. Flow reductions also were predicted for Susie Creek, which is considered a recovery site for this species. Habitat reductions could result in reduced numbers, if a substantial amount of habitat is removed. Since only the lower portions of occupied habitat may be affected, the viability of these isolated and self-sustaining trout populations would be subject to higher risks of elimination because of restricted habitat and potential loss from catastrophic events. Potential reductions in flows of Maggie Creek could have adverse effects on the potential for the meta-population of Lahontan cutthroat trout in the Maggie Creek basin. The Maggie Creek Watershed Restoration Program has significantly improved stream and riparian habitats since 1993. The program was designed to enhance 1,982 acres of riparian habitat and 82 miles of stream channel in the Maggie Creek basin.

The U.S. Fish and Wildlife Service has commented that some of the dewatering impacts to Lahontan cutthroat trout may occur decades or more after mine dewatering ceases. Lahontan cutthroat trout populations in the small streams in the Maggie Creek watershed above 6,000 feet elevation may continue to exist at some level of abundance, but as a result of the dewatering impacts in the Maggie Creek basin in the future, these populations may be lost to some catastrophic event, such as drought or fire. With no meta-population structure within the Maggie Creek basin to provide Lahontan cutthroat trout for re-occupation of the habitat after it improves, these small stream populations of Lahontan cutthroat trout may be lost over the long-term (Williams, 1999).

Mine dewatering could adversely affect habitat for the spotted frog, California floater, and springsnails. Flow reductions in the Maggie Creek subbasin and lower Rock Creek could decrease habitat used by California floater. Colombia spotted frog could also be affected in Maggie Creek. Springsnails are present in five springs in the cumulative assessment area that could potentially be affected by dewatering drawdown. If any of the springs are dewatered, the population in that spring would be lost.

Impacts to the Humboldt River

Discharges to the Humboldt River would result in impacts to the same terrestrial species listed above. Increased flows in the Humboldt River could result in increased riparian

vegetation, which could be used by these species for cover, feeding, breeding, and other biological requirements. The potential impacts to species occurring in the Humboldt Sink area from chemical constituents of concern are summarized in the terrestrial wildlife resource Section.

Livestock Grazing

Predicted Dewatering Effects

Water drawdown resulting from mine-related dewatering activities may affect various water sources used by livestock including improved springs and pipelines, stock wells, springs, seeps, and perennial stream reaches. Impacts may include reduced flow or complete cessation of flow in springs and other water sources. Grazing allotments that could be affected by the potential loss of water sources include the Twenty-five, T-Lazy S, Hadley, Carlin Field, McKinley and Marys Mountain allotments. The potential loss of improved springs and the minor reduction of baseflow in perennial stream reaches would not likely result in the loss of animal unit months within the Carlin Field, Carlin Canyon, Blue Basin, Lone Mountain, Adobe, Adobe Hills, Palisade, or Horseshoe allotments.

The majority of water-related range improvements and perennial waters located in the T Lazy S allotment could be affected by ground water drawdown. Three stock wells and eight improved springs that supply water to two water pipelines and four stockwater ponds in the central portion of the allotment could be affected. The 1993 Mitigation Plan has specific commitments to supplement or augment spring flows if they are affected by dewatering. Segments of Bell, Welches, Marys, James, Simon, Jack, and Coyote creeks could experience reduced flows. The potential loss of these water sources would reduce the number of animal unit months in the allotment.

Drawdown could affect three improved springs and one natural spring in the Marys Mountain allotment. Perennial reaches of Marys and James creeks, lower Maggie Creek and natural springs within each watershed also could be affected. The potential loss of water sources and amount of available water would likely result in the long-term loss of animal unit months within the allotment.

Impacts to the Humboldt River

Increased water levels within the Humboldt River floodplain would likely increase the areal extent of herbaceous wetlands and irrigated hay meadows within and adjacent to the floodplain. Forage production and the carrying capacity of these areas also would likely increase. Increased water levels also would increase the availability of water for livestock use. Discharge waters reaching the Humboldt and Carson Sinks would not affect grazing management since livestock grazing is not allowed within these areas.

Recreation

The cumulative effects on recreation along the Carlin Trend are twofold: one, in the short-term, the projects would remove over 34,000 acres from public lands available for recreation. Two, mining projects have the potential to alter access to and the physical and visual setting of an area over the long-

term, with resulting impacts on persons pursuing recreation in the area. After 2011, and after reclamation of the various projects are complete, much of the area would again be available for recreation. However, open pits and steep sloped areas may comprise several thousand acres that would not be suitable for recreation over the long-term.

However, there are no developed recreation sites along the Carlin Trend that would be impacted. There would be no new kinds of pressures placed on recreational facilities in the area, but existing pressures would be extended to the year 2011. Dispersed recreation in the area (primarily hunting and off-road vehicle use) is relatively minor (in part because existing mining operations have fenced and prohibited access to large areas already). In general, the cumulative acreages removed by the mining projects would be considered minor relative to the area available for similar uses in adjacent areas of public lands.

Visual Resources

The primary viewing locations of the Carlin Trend area are from Interstate 80, State Highway 766 north of Carlin, and State Highway 278 south of Carlin. Views from Interstate 80 would only be affected by Newmont's Gold Quarry Project. Views from State Highway 766 would be affected by several Newmont projects, including the North Area Haul Road, future development at the Pete Deposit, the Carlin Mine, future development at the High Desert project, and future development at the Chevas project. Views from State Highway 278 would possibly be affected by Newmont's Rain/SMZ and Emigrant Springs projects nearly six miles east of the highway. All other projects listed in the cumulative effects area are located on the west side of the Tuscarora Mountains or in the Boulder Creek valley where they are largely outside the viewsheds of major public highways.

Cumulative visual impacts would include major but short-term contrasts between steam or vapor plumes (gray to white) from plants and cooling towers and the brown and tan earth and vegetation colors seen as background to the plumes. Visual impacts from structures would be minor and short-term. The largest magnitude visual effect would result from creation of large angular landforms that would contrast strongly with natural landforms until reclamation, when angularity and color contrast would be reduced by reclamation activities. None of the reasonably foreseen mining activities on the Carlin Trend are expected to compromise the Visual Resource Management objectives for Class III and Class IV lands, and cumulative impacts are expected to be moderate.

Noise

Noise levels would be expected to increase over time, especially if several of the reasonably foreseeable projects were developed concurrently, and especially if the projects were adjacent, even though project noise sources may be miles apart. After mining and reclamation are completed, noise levels would return to near pre-mining levels. No noise sensitive areas or receptors would be adversely affected by cumulative development along the Carlin Trend.

Land Use and Access

The known and reasonably foreseeable activities would disturb approximately 34,000 acres by 2011. During active operations, public access is prohibited for safety reasons. Following mining and reclamation, access and pre-mining land uses would be restored. Restored access to the areas may be altered as a result of the new landforms created. A portion of the sites (open pits, steep slopes) would not be returned to their pre-mining land use, and these could comprise from 4,800 to 9,600 acres (15 to 30 percent disturbance area). Pre-mining uses of groundwater and surface water could be affected within the area of the 10-foot drawdown contour for the long-term.

Cultural Resources

Known and reasonably foreseeable actions in the Gold Quarry area could bring about increased disturbance beyond that proposed in this EIS. Future disturbance could adversely effect eligible cultural resources in the Gold Quarry area. However, any future proposed disturbance to significant cultural resources would be offset by mitigation measures approved by the BLM after consultation with the Western Shoshone and the Nevada SHPO. Thus, there are no cumulative adverse effects to cultural resources expected as a result of the Proposed Action.

Native American Religious Concerns

The assessment of Native American concerns was based on two types of information. Initially, emphasis was placed on the review of existing literature. Sources reviewed included ethnographic reports and monographs that address the region and manuscripts and material on file with the BLM. The various bands of the Te-Moak Tribe of Western Shoshone, the Duck Valley Tribal Council, the Shoshone-Bannock Tribe, the Western Shoshone Defense Project, and the Western Shoshone Historic Preservation Society were contacted by the BLM.

Information derived from these sources indicate that ground water drawdown could have an effect on resources of specific concern to Native Americans. Water is central to all living and spiritual things. The Western Shoshone feel that predicted impacts to stream flows, springs, and seeps would have a particularly adverse effect. Impacts would occur to riparian communities and animals that depend on those communities. The Western Shoshone are very concerned with the direct impacts that would occur to water, plants, and animals, especially sage grouse. Of even greater concern to the Western Shoshone are the disruptions that could occur to life and spirit forces found in or associated with these waters, plants, and animals. Impacts would occur to two areas identified by BLM as traditional cultural properties. Impacts to those areas would affect the ability of the Western Shoshone to maintain cultural traditions. Any potential adverse effects to the two identified TCPs, however, would be prevented or offset. Details of the monitoring and mitigation plan will be forthcoming in the final EIS for this project.

In summary, the Western Shoshone believe that ground water drawdown would have an adverse impact on both the physical and

spiritual worlds. Impacts of the magnitude proposed are dangerous in that they would substantially alter the intricate web of power relationships that exist in nature and between the Western Shoshone and Mother Earth. Details of these findings can be found in the Cumulative Impacts Analysis for Mine Dewatering, a separate technical analysis completed in conjunction with the SOAPA EIS (BLM, 2000b).

Social and Economic Resources

Predicted Dewatering Effects

A total of 147 water supply wells that have current permits or certificate status with respect to water rights issued by the State Engineer (excluding wells owned or affiliated with Barrick or Newmont) would be affected by drawdown. A majority of the 147 wells are for purposes of stock watering (26 percent), mining/milling (14 percent), and irrigation (44 percent).

Springs with reduced flow may affect some water sources for livestock and wildlife, resulting in socioeconomic impacts to affected livestock owners and the state's wildlife resources. Springs that support domestic water supply to the town of Carlin (i.e., Carlin Cold Springs in the Marys Creek drainage) could also be affected by dewatering in the Carlin Trend.

A total of 44 surface water rights have been identified within the potential cumulative ground water drawdown area; 28 of these water rights are for irrigation or livestock watering. Therefore, socioeconomic impacts probably would occur from reduced streamflow for these designated uses.

Impacts to the Humboldt River

Since the Humboldt River is over-appropriated, the additional excess mine water would be a positive effect to water right holders in the basin. Potential effects from increased flow in the Humboldt River could include limited additional flooding during periods of high flow. The additional inundated area would likely be limited to the immediate vicinity of the river and generally would involve lower elevation hayfields and meadows, therefore, no major socioeconomic impacts would be expected. If additional mine discharge water during high-flow periods contributes to approaching the capacity of Rye Patch Reservoir, damage could occur to the conveyance canals and gates and cause flooding of agricultural fields downstream from the reservoir.

Based on general irrigation flow data, approximately 30,000 to 60,000 ac-ft/yr of mine discharge may reach the Humboldt and Carson Sinks if not consumed upstream by irrigation practices. As a result, greater water depths and areas of inundation could occur in the sinks from the additional water. This could have an effect on water availability for wildlife and possibly create an effect on agricultural drainage conditions upstream of the Humboldt Sink if the additional flow is excessive. These effects would have a duration approximately equal to the projected life of the combined mine discharges.

Increased water in the Humboldt River may limit the ability to repair irrigation diversion structures during the low-flow periods.

Irrigators typically repair these structures as needed when river flow has declined in the fall. The increased flow from mine discharges may cause more water to be in contact with the irrigation structures on a year-round basis and make it more difficult to perform the necessary repairs.

The predicted long-term decrease in Humboldt River flow would range from about 9 to 14 percent and could extend for a period of more than 100 years. The ability for some agricultural operations to irrigate late season hay or to water livestock may be limited by decreases in flow. Specific irrigators with more junior water rights may have reduced access to water. Newmont, owner of the T Lazy S Ranch, will reduce its rate of diversions to compensate for any baseflow reductions in the Humboldt River as part of the SOAP Mitigation Plan.

Wastes - Solid or Hazardous

Volumes of solid waste generated are highly variable from large operators, such as a surface mine, to an underground mine, to an exploration drilling project that would generate the least amount of solid waste. Currently, non-hazardous solid wastes can be disposed of in one of two ways: (1) an operator can request a permit for an on-site Class III landfill waiver, construct the landfill and dispose of wastes on-site, or (2) the operator can transport the waste to existing county landfills in Elko or Eureka counties. In light of the over 30 known or reasonably foreseeable projects, Elko and Eureka counties would experience either a great increase in permit applications for on-site landfills, or the counties would experience significant increases in solid wastes being hauled to the county landfills.

Hazardous wastes are subject to stringent permitting requirements. Currently, Newmont and Barrick are the largest among only a handful of operators classified as hazardous waste generators. All hazardous wastes must be handled according to approved permits or be disposed of according to state or federal regulations. The known and reasonably foreseeable project would cumulatively result in larger volumes of hazardous wastes stored on site, transported on state and federal highways, and disposed of in approved disposal sites. The volumes of hazardous wastes cannot be quantified until future hazardous waste generators are identified.

The frequency of transportation spills is not expected to change significantly because active projects may close down as new projects come on-line. The frequency of on-site spills is also expected to remain similar to current rates for the same reason. All mines are mandated to have Spill Prevention, Control, and Countermeasure Plans in place as part of their state/federal discharge permits to mitigate the effects of spills.

Environmental Justice

No cumulative effects on environmental justice are expected because the known and reasonably foreseeable projects are all located in an area remote from population centers, an area already affected by mining operations, and by an industry that has already demonstrated that it hires employees from all communities and socioeconomic levels.

CHAPTER 6
CONSULTATION, COORDINATION, AND PREPARATION

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PUBLIC PARTICIPATION SUMMARY

This Public Participation Summary is specific to the proposal presented in Newmont's Plan of Operations for the SOAPA. The summary indicates means of public involvement, identifies persons and organizations to be contacted for comments and feedback, and specifies time frames for accomplishing goals in accordance with 40 CFR 1506.6.

This summary includes the necessary steps for public involvement in the EIS process to identify and deal with public concerns and needs. This process assists in: (1) broadening the information base for decision making; (2) informing the public of the proposal and long-term impacts resulting from the action; and (3) ensuring that public needs and desires are understood by BLM.

Public notice and opportunity for participation are required at four specific points in the EIS process: the scoping period, review of the Draft EIS, review of the Final EIS, and receipt of the Record of Decision.

- The 30-day scoping period provided the public the opportunity to identify potential issues associated with the Proposed Action that might warrant analysis during development of the Draft EIS.
- The 60-day review of the Draft EIS is initiated by publication of a Notice of Availability for the Draft EIS in the Federal Register. During the review period, public hearings may be held in Elko to obtain comments.
- The 30-day review of the Final EIS is initiated by publication of a Notice of Availability for the Final EIS in the Federal Register.
- Subsequent to the 30-day review of the Final EIS, the Record of Decision will be prepared and a Notice of Availability for the Record of Decision will be published in the Federal Register.

IMPLEMENTATION

1. The scoping period was initiated by publication of a Notice of Intent on June 19, 1997. The Notice of Intent summarized the Proposed Action and BLM's determination that an EIS was necessary for analysis of the proposal. Appropriate news media and the public were notified of the periods available for comment through publication of the scoping process in the Elko Daily Free Press. Information was sent to the following list of media outlets:

Desert News Salt Lake City, UT	The Statesman Boise, ID
Eureka Sentinel Tonopah, NV	Salt Lake Tribune Salt Lake City, UT
Las Vegas Sun Las Vegas, NV	Las Vegas Review Las Vegas, NV
Humboldt Sun Winnemucca, NV	Ely Daily News Ely, NV
Reno Gazette Journal Reno, NV	Associated Press Reno, NV
High Desert Advocate Wendover, NV	United Press International Carson City, NV
Numa News Fallon, NV	North American Mining Reno, NV
KRJC Radio Elko, NV	Elko Daily Free Press Elko, NV
KENV TV Elko, NV	KELK Broadcasting Co. Elko, NV
Karen Terrell	Independent News Contractor Times News, Elko, NV

Written notification and briefing of the scoping period were also given to the Elko and Eureka County Commissioners.

A formal public scoping meeting was held in Elko, Nevada, on July 9, 1997. In addition to the officials and agencies identified above, 214 scoping letters were sent to various agencies, groups, and individuals. Each of the 13 individuals who attended the scoping meeting held in Elko also received a copy of the scoping letter.

Scoping comments were accepted until July 18, 1997. During that period a total of six written responses were received from individuals and groups. This includes comments received from the Nevada State Clearinghouse. A Public Scoping Report was developed by BLM in August 1997 that summarized the scoping process and comments.

2. An EIS mailing list of interested persons was assembled from previous mining-related EIS mailing lists and from names of participants who attended the scoping meeting. This list will be continuously updated as needed throughout the EIS process.

3. Distribution of the Draft EIS will occur as follows:

   - A Notice of Availability will be published in the Federal Register specifying the dates for the comment period and the dates, times, and locations of public hearings.

   - In conjunction with the 60-day comment period on the Draft EIS, a news release will be developed and submitted to relevant news outlets through the Elko Field Office of the BLM.

   - The Draft EIS will be distributed to interested parties identified on the updated EIS mailing list.

   - Public meetings may be held in Elko to obtain comments on the Draft EIS approximately 30 to 45 days after publication of the Federal Register Notice.

4. The Final EIS will be completed considering comments from the review of the Draft EIS and released as follows:

   - A Notice of Availability will be published in the Federal Register.

   - Copies of the final document will be sent to all those on the updated mailing list.

   - A news release will be issued to relevant news outlets through the Elko Field Office of the BLM.

5. The Record of Decision will be distributed to people and organizations on the updated mailing list, and a Notice of Availability will be published in the Federal Register. Briefings will be offered to the Nevada Clearinghouse and conducted, as required. A news release will be issued to relevant news outlets to announce distribution of the Record of Decision.

CRITERIA AND METHODS BY WHICH PUBLIC INPUT IS EVALUATED

Substantive comments from letters and testimony concerning the Draft EIS will be reviewed and evaluated by BLM to determine if information is presented that requires a formal response or contains new data to be brought to the attention of the BLM which identifies deficiencies in the Draft EIS. Steps would then be initiated to correct such deficiencies and to incorporate the information into the Final EIS.

CONSULTATION WITH OTHERS

The following local, state and federal agencies were consulted during preparation of this EIS:

- Eureka County
- Elko County
- Nevada Division of Wildlife
- Nevada Department of Conservation and Natural Resources
- U.S. Army Corps of Engineers
- U.S. Environmental Protection Agency Region IX
- U.S. Fish and Wildlife Service

LIST OF PREPARERS AND REVIEWERS

USDI Bureau of Land Management, Elko Field Office

Name	**Contribution**
Roger Congdon	Project Lead/Surface and Groundwater/Air Quality
Deb McFarlane	Assistant Project Lead/ Geology/Minerals, Hazardous Materials
Paul Myers	Socioeconomics
Carol Evans	Fisheries/T&E/Riparian
Ken Wilkinson	Wildlife/TECS Species

Bryan Hockett	Cultural Resources/ Native American Religious Concerns/ Paleontology
Carol Marchio	Water Rights/Soils
Tom Olsen	Groundwater Model
Donna Nyrehn	Grazing/Vegetation
Susan Elliot	Access/Land Use
Evelyn Treiman	Recreation/Visual/ Wilderness
Janice Stadelman	Technical Operations Advisor/Compliance
Bob Marchio	NEPA Coordinator

Greystone Environmental Consultants, Inc.

Name/Degree/Years of Experience	Contribution
Jerry H. Koblitz B.S. Wildlife Management, 27 years	Project Manager/ Principal Review
Dehn Solomon B.A., M.S. Biology 28 years	Technical Editor
Michael J. Bonar B.S. Environmental Biology, 9 years	Wildlife Biology
David M. Cameron B.S. Biology M.S. Animal Ecology, 19 years	Wildlife Biology, TECS Animals
Donald A. Douglas B.S., M.S. Meteorology 28 years	Air Quality, Noise
Larry Keith Bachelor of Landscape Architecture, 23 years	Visual Resources
Mark A. Laverty Assoc. of Occupational Studies, 12 years	GIS/CAD Support
William B. Mahoney B.A. Geology M.A. Geography 18 years	Soils, Geology
Kathy Russell B.A. Biology M.S. Plant Ecology 8 years	Vegetation, Range, TECS Plants, Wetlands
Elizabeth Welch B.S. Earth Sciences 8 years	Recreation, Land Use, Public Access
John E. Forsythe B.A. Environmental Planning, Master of Planning, 11 years	Socioeconomics

Hydro-Geo Consultants, Inc.

Joe Frank BA Geology MS Hydrology 25 years	Groundwater and Surface Water
Gabriele Walser PhD. Civil Engineering Hydrology, P.E. Civil Engineering, 8 years	Groundwater and Surface Water
Ramsay McDermid MS Civil Engineering P.E. Civil Engineering, 25 years	Surface Water

Sandia National Laboratories

Tom Corbet	Groundwater Model Code Review
Pat Knupp	Groundwater Model Code Review

Cooperating Agencies

Laura Berglund/ Peter Tuttle/ Stan Weimeyer	U.S. Fish and Wildlife Service, TECS Species
Rory Lamp	NDOW, Wildlife
John Balliette Pete Goicoechea	Eureka County

LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM THE DEIS WAS SENT

Elected Officials

Representative Jim Gibbons, Washington, DC
Dean Rhoads, Northern Nevada Senatorial District, Tuscarora, NV
Governor Kenny C. Guinn, Carson City, NV
Senator Harry Reid, Carson City, NV
Senator Richard Bryan, Reno, NV
Assemblyman John Marvel, Battle Mountain, NV
Assemblyman John Carpenter, Elko, NV
Assemblyman Clifton Young, Reno, NV

Federal Agencies

BLM Nevada State Office, Reno, NV
BLM Carson City Field Office, Carson City, NV
BLM (Wo-480), Washington, DC
BLM Ely Field Office, Ely, NV
BLM Las Vegas Field Office, Las Vegas, NV
U.S. EPA Region 8, Denver, CO
Environmental Review Coordinator - EPA, Region IX, San Francisco, CA
Office of Public Affairs, Washington, DC
Offshore Environmental Assessment Division, Washington, DC
Regional Director, U.S. Fish & Wildlife Service, Portland, OR
Interior Department, Washington, DC
Natural Resources Library, Department of Interior, Washington, DC
National Park Service (2310), Washington, DC
Director, USDI, BLM Washington, DC
BLM Battle Mountain Field Office, Battle Mountain, NV
BLM Winnemucca Field Office, Winnemucca, NV
Office of Environmental Policy & Compliance - USDI, Washington, DC
Environmental Affairs Program - USGS, National Center (423), Reston, VA
Chief, Division of Environmental Coordination, U.S. Fish & Wildlife Service, Washington, DC
Bureau of Reclamation, Environmental Office, D-5150, Denver, CO
Director, Office of Federal Activities - EPA, Washington, DC
Office of Environmental Compliance (Eh-42), Washington, DC
Centers for Disease Control, Atlanta, GA
Humboldt National Forest, Elko, NV
Bureau of Indian Affairs, Eastern Nevada Agency, Elko, NV
Library of Congress, Washington, DC
US Environmental Protection Agency, Las Vegas, NV
Office of Deputy A/s of USAF, Environmental, Safety, Occupations Health, Washington, DC
Advisory Council on Historic Preservation, Washington, DC
Natural Resources Conservation Service, Elko, NV
US Army Corp of Engineers, Reno, NV
Division of Environmental Affairs, Bureau of Reclamation, Washington, DC

Office of Federal Activities, Washington, DC
Office of Federal Activities, EPA, Region IX, San Francisco, CA
HQ-USAF/LEEV, Environmental Division, Washington, DC
Mr. Henry W. Kipp, BIA, National Nris Coordinator, Washington, DC
USDA, Natural Resources Conservation Service, Reno, NV
Department of Commerce, National Weather Service, Elko, NV

State Agencies

Division of Water Planning, Carson City, NV
Office of Community Services, State of Nevada, Carson City, NV
Nevada Division of Water Resources, Elko, NV
Nevada State Clearinghouse, Division of Administration, Carson City, NV
State Historic Preservation, Carson City, NV
State Multiple Use Advisory Board, Carson City, NV
Nevada Department of Minerals, Carson City, NV
Nevada Department of Transportation, Carson City, NV
Nevada Division of Wildlife, Elko, NV
Nevada Division of Forestry, Elko, NV
Nevada Natural Heritage Program, Carson City, NV
Division of State Lands, Land Use Planning, Carson City, NV
NENDA, Elko, NV
NDEP-Bureau of Mining Regulations and Reclamation, Carson City, NV
Division of Minerals, Las Vegas, NV

City and County Including Semi-Public Groups like the Chamber of Commerce

City Mayor, Elko, NV
City Mayor, Carlin, NV
Mr. George Boucher, Elko County Manager, Elko, NV
Eureka County Commissioners, Eureka, NV
Lander County Commission, Austin Office, Austin, NV
Elko City Planning Board, Elko, NV
Carlin Planning Board, Carlin, NV
Public Land Use Planning Commission, Elko, NV
Wells Chamber of Commerce, Wells, NV
Eureka County Public Land Advisory Commission, Eureka, NV
Charlotte Healey, Wells Admin., Wells, NV
City Manager, Elko, NV
Linda Bingaman, City of Carlin, Carlin, NV
Chair Elko County Comm, Elko County Courthouse, Elko, NV
Lander County Commission, Battle Mountain, NV
Elko Chamber of Commerce, Elko, NV
Nevada Association of Ctys, Carson City, NV
City of Wells, Wells, NV

Mining Companies and Representatives

Mike Malmquist, Parons Behle & Latimer, Salt Lake City, UT
Newmont Gold Company, Reno, NV
Legarza Exploration, Elko, NV
Franco-NV Mining Corporation, Reno, NV
Paul Scheidig, Nevada Mining Association, Reno, NV
Cortez Gold Mines, Beowawe, NV
Newmont Gold Company, Denver, CO
Tri Quest Resources, Natches, MS
Independence Mining Company, Elko, NV
Dee Gold Mine, Valmy, NV
Newmont Gold Company, Valmy, NV
Barrick Goldstrike, Elko, NV
Bob Bryson, Glamis Marigold Mine, Valmy, NV
Royal Gold, Denver, CO

Local and State Libraries and Media

Nevada State Library, Carson City, NV
Eureka County Library, Eureka, NV
University of Nevada, Las Vegas Library, Las Vegas, NV

Battle Mountain Band Council, Lydia Johnson, Battle Mountain, NV
Elko, County Library, Elko, NV
Delamare - Linda Newman/262, University of Nevada, Reno, NV
Great Basin College Library, Elko, NV
Lander County Library, Battle Mountain, NV
James Dickenson Library, University of NV, Las Vegas, NV
Elko Daily Free Press, Elko, NV
Salt Lake City Public Library, Salt Lake City, UT
White Pine County Library, Ely, NV

Native American and Members of Groups Promoting Native American Interests

Maurice Frank, Yomba Tribe, Austin, NV
Rebecca Leigh Joyce, Member - W.S.H.P.S., Harrisonburg, VA
Marvin McDade, Chairman, Southfork Band Council, Lee, NV
Nevada Penoli Chairman, Wells Band Council, Wells, NV
Elwood Mose, Chairman, Te-Moak Tribe of Western Shoshone, Elko, NV
Wilbur Woods, Chairman, Elko Band Council, Elko, NV
Marvin Cota, Chairman, Shoshone Paiute Tribal Council, Owyhee, NV
Goshute Band Council, Ibapah, UT
Robert Healy, Jr., Elko Indian Colony, Elko, NV
Donna Hill, Battle Mountan Band Council, Battle Mountain, NV
Virginia Sanches, Native American Program, Reno, NV
Western Shoshone Defense Project, Crescent Valley, NV
W.S.H.P.S. Executive Board of Trustees, Elko Indian Colony, Elko, NV
Battle Mountain Indian City, Battle Mountain, NV
Jerry Millett, Chair, Duckwater Shoshone Tribe, Duckwater, NV
Fort Hall Indian Reservation, Shoshone-Bannock Tribes, Fort Hall, ID
Bureau of Indian Affairs, Eastern Nevada Agency, Elko, NV
Wells Band Council of Western Shoshone, Nevada Penoli, Chairperson, Wells, NV
W. Shoshone Historic Preservation Society, Elko Indian Colony, Elko, NV
Honorable John Ensign, Las Vegas, NV
Gordon Temoak, Traditional Chief of Western Shoshone, Wells, NV
Intertribal Council of Nevada, Chairperson, Reno, NV
Arthur Kaamasee, Chairman, Ely Shoshone Tribe, Ely, NV

Environmental Groups and Representatives

Tom Myers, Great Basin Mine Watch, Reno, NV
Barbara Spolter, The Wilderness Society, San Francisco, CA
Glenn Miller, Mining Chr, Sierra Club, Toiyable Chapter, Reno, NV
Nevada Wildlife Federation, Carson City, NV
The Nature Conservancy of Nevada, Northern Nevada Office, Reno, NV
Sierra Club Toiyable Chapter, Reno, NV

Local Stakeholders

26 Corporation, Battle Mountain, NV
Maggie Creek Ranch, Inc., Elko, NV
Agri Beef Company, Tuscarora, NV
Palisade Ranch, Inc., Carlin, NV
Nevada Woolgrowers Assoc, Eureka, NV

Individuals and Organizations and Companies Without Clear Affiliation

Mark Dubois, Elko, NV
Robert Michna, Carlin, NV
John Geddie, Albuquerque, NM
Joe Sustacha, Jr. & Son, Lamoille, NV
George Brown, Mead, WA
Houston Kempton, Exponent, Boulder, CO

Mike McFarlane, Great Basin College, Elko, NV
Paul and Valery Pettit, Spring Creek, NV
Mark Sanders, Elko, NV
Alan Sweide, Elko, NV
Felix Ike, Elko, NV
John Lovermore, Reno, NV
Bill Ray, Altus, OK
Jim Pond, Elko, NV
Lee Taylor, Carlin, NV
Mike McDonald, Ironworkers Local 27, Salt Lake City, UT
John Thomas, SWCA Inc., Salt Lake City, UT
Myrtle Coltharp, Salt Lake City, UT
Sierra Pacific Power Company, Elko, NV
Bennie Hodges, PCWDC, Lovelock, NV
Bob Ingersol, Salt Lake City, UT
Bruce Jenkins, Hunter Dickinson Inc., Vancouver, BC, Canada
Randy Vance, Elko, NV
Glen Lewis, Elko, NV
Bruce Miller, Elko, NV
Edward S. Syrjala, Centerville, MA
TS Joint Venture, Battle Mountain, NV
Chris Sewall, Crescent Valley, NV
Mike Glock, Elko, NV
Zeda Inc., Horseshoe Ranch, Beowawe, NV
Adobe Hills Ranch LLC, Elko, NV
Gordon Peake, Elko, NV
R. Ruis, HSI GeoTrans, Reno, NV
Hooper, Wolf & Garrett Families, Elko, NV
Robert J. Glennon, University of Arizona, Tucson, AZ
E.C.E.D.A., Elko, NV
Elden E. Hughes, Whittier, CA
Humboldt River Basin Water Authority, Carson City, NV
Roger Flynn, Western Mining Action Project, Boulder, CO
Battle Mountain Bugle, Battle Mountain, NV
Jim Kuipers, Center for Science in Public Participation, Boulder, MT
Howard Wilshire, Chairman, Borad of Directors, Sebastopol, CA

CHAPTER 7
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GLOSSARY

Acid Rock Drainage - Drainage with a pH of 2.0 to 4.5 from mines and mine wastes that is the result of oxidation of sulfides exposed during mining.

Acre-feet - The volume of liquid or solid required to cover one acre to a depth of one foot, or 43,560 cubic feet; measure for volumes of water, reservoir rock, etc.

Allotment - A unit of land suitable and available for livestock grazing that is managed as one grazing unit.

Alluvium - Unconsolidated or poorly consolidated gravel sands and clays, deposited by streams and rivers on riverbeds, floodplains, and alluvial fans.

Ambient - The environment as it exists at the point of measurement and against which changes or impacts are measured.

Angle of Repose - The maximum angle of slope at which loose, cohesionless material remains stable. It commonly ranges between 33° and 37° on natural slopes.

Animal Month - For a cow/calf operations, it is the amount of forage consumed by a 1,000 pound cow and calf (less than 6 months of age) over a one month period. It is approximately 1,050 pounds of forage.

Animal Unit Months (AUMs) - For the BLM allotments, it is the amount of forage consumed by a 1,000 pound cow over a one month period, approximately 800 pounds of forage. An animal unit month is then multiplied by 1.32 for a cow/calf operation such as the Mahala Creek allotment, and is equivalent to an animal month for purposes of this document.

Anomaly - A geological feature, especially in the subsurface, distinguished by geological, geophysical, or geochemical means, which is different from the general surroundings.

Aquatic Resources - Biological resources (plants, animals, and other life forms) present in or dependent on streams, lakes, and other surface water.

Aquifer - A body of rock that is sufficiently permeable to conduct groundwater and to yield economically significant quantities of water to wells and springs.

Aspect - The direction toward which a slope faces with respect to the compass or the sun.

Assemblage - A group of rocks grouped together by age or similar origin.

Asymtote - Asymtotically - A straight line associated with a curve such that as a point moves along an infinite branch of the curve the distance from the point to the line approaches zero.

Background - The viewing area of a distance zone that lies beyond the foreground-middleground. Usually from a minimum of 3 to 5 miles to a maximum of about 15 miles from a travel route, use area, or other observer position. Atmospheric conditions in some areas may limit the maximum to about 8 miles or increase it beyond 15 miles.

Baseline Study - A study conducted to gather data prior to mining for the purpose of outlining conditions existing on an undisturbed site. Impacts are evaluated against the baseline data and reclamation success is measured against baseline data.

Biodiversity - The diversity of species, ecosystems, and natural processes in an area.

Broadcast seeding - Distribution of seed by a fan spreader or by hand spreading.

CFR - Code of Federal Regulations, the compilation of federal regulations adopted by federal agencies through a rule-making process.

Characteristic Landscape - The established landscape within an area being viewed. The term does not necessarily mean a naturalistic character, but may refer to features of the cultural landscape, such as a farming community, an urban landscape, or other landscape that has an identifiable character.

Colluvium - General term applied to loose and incoherent deposits, usually at the foot of a slope of cliff and brought there chiefly by gravity; such as talus and cliff debris.

Community Types (vegetation) - A group of plants living in a specific region under relatively similar conditions.

Contrast - The effect of a striking difference in the form, line, color, or texture of the landscape features within the area being viewed.

Cultural Resources - The archaeological and historical remains of human occupation or use. Includes any manufactured objects, such as tools or buildings. May also include objects, sites, or geological/geographical locations significant to Native Americans.

Cumulative Effects -As defined by 40 CFR 1508.7, cumulative effects are the impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

dBA - The sound pressure levels in decibels measured with a frequency weighing network corresponding to the A-scale on a standard sound level meter. The A-scale tends to suppress lower frequencies, e.g., below 1,000 Hz.

Debitage - Chipped stone flaking debris resulting from stone tool making.

Decibel (dB) - A unit used in expressing ratios of electric or acoustic power. The relative loudness of sound.

Direct Effects - As defined by 40 CFR 1508.9, these are effects which are caused by the action and occur at the same time and place as the action. Synonymous with direct impacts.

Discharge - The volume of water flowing past a point per unit time, commonly expressed as cubic feet per second (cfs), gallons per minute (gpm), or million gallons per day (mgd).

Disturbed Area - Area where natural vegetation and soils have been removed or disrupted.

Drainage - Natural channel through which water flows some time of the year. Natural and artificial means for effecting discharge of water as by a system of surface and subsurface passages.

Drawdown - The lowering of the water level in a well as a result of withdrawal.

Earthquake - Sudden movement of the earth's crust resulting from faulting, volcanism, or other mechanisms.

Endangered Species - Any species in danger of extinction throughout all or a significant portion of its range. Plant or animal species identified by the Secretary of the Interior as endangered in accordance with the 1973 Endangered Species Act.

Ephemeral Stream - A stream or portion of a stream that flows briefly in direct response to precipitation in the immediate vicinity, and whose channel is at all times above the water table.

Erosion - The wearing away of soil and rock by weathering, mass wasting, and the action of streams, glaciers, waves, wind, and underground water.

Evapotranspiration - The portion of precipitation returned to the air through evaporation and plant transpiration.

Exploration - The search for economic deposits of minerals, ore, and other materials through practices of geology, geochemistry, geophysics, drilling, and/or mapping.

Fault - Surface of rock rupture along which has been differential movement.

Fisheries - Streams and lakes used for fishing.

Floodplain - That portion of a river valley, adjacent to the channel, which is built of sediments deposited during the present regimen of the stream and is covered with water when the river overflows its banks at flood stages.

Footprint - The actual surface area physically disturbed by mining operations and ancillary facilities.

Forage - Vegetation used for food by wildlife, particularly big game wildlife and domestic livestock.

Forb - Any herbaceous plant other than a grass.

Foreground-Middleground - The area visible from a travel route, use area, or other observer position to a distance of 3 to 5 miles. The outer boundary of this zone is defined as the point where the texture and form of individual plants are no longer apparent in the landscape, and vegetation is apparent only in pattern or outline.

Fugitive Dust - Dust particles suspended randomly in the air from road travel, excavation, and rock loading operations.

Game Species - Animals commonly hunted for food or sport.

Geochemistry - The study of the distribution and amounts of the chemical elements in minerals, ores, rocks, soils, water, and the atmosphere, and their circulation in nature, on the basis of the properties of their atoms and ions.

Geotechnical - A branch of engineering concerned with the engineering design aspects of slope stability, settlement, earth pressures, bearing capacity, seepage control, and erosion.

Grade - A slope stated in terms of feet per mile or as feet per feet (percent); the content of precious metals per volume of rock (ounces per ton).

Ground Cover - The amount of ground surface covered by vegetation.

Ground Water - All subsurface water, especially that as distinct from surface water portion in the zone of saturation.

Ground Water Table - The surface between the zone of saturation and the zone of aeration; that surface of a body of unconfined ground water at which the pressure is equal to that of the atmosphere.

Habitat - The place or type of site where a plant or animal naturally or normally lives and grows. Includes all biotic, climatic, and soils conditions, or other environmental influences affecting living conditions.

Haul Road - All roads utilized for transport of an extracted mineral, waste, overburden, or other earthen materials.

Heavy Metals - A group of elements that may be acquired by organisms in trace amounts that are toxic in higher concentrations. Includes copper (Cu), lead (Pb), mercury (Hg), molybdenum (Mo), nickel (Ni), cobalt (Co), chromium (Cr), iron (Fe), silver (Ag), etc.

Herbaceous Perennials - Leafy, non-woody plants with fleshy stems that have a life span of more than two years.

Host Rock - A body of rock serving as a host for mineral deposits.

Hydrology - A science that deals with the properties, distribution, and circulation of surface and subsurface water.

Hydrophytic Vegetation - Plants that grow in and are adapted to an aquatic or very wet environment.

Hydrostatic Head - The height of a vertical column of water, the weight of which, if of unit cross-section, is equal to the hydrostatic pressure at a point.

Igneous - Rock or mineral that solidified form molten or partly molten magma, processes relating to or resulting from the information of such rocks.

Impoundment - The accumulation of any form of water in a reservoir or other storage area.

Indirect Effects - As defined by 40 CFR 1508.8, these are effects which are caused by the action but occur later in time or are removed in distance from the action, but are still reasonably foreseeable. Synonymous with indirect impacts.

Infiltration - The movement of water or some other liquid into the soil or rock through pores or other openings.

Infrastructure - The basic framework or underlying foundation of a community including road networks, electric and gas distribution, water and sanitation services, and facilities.

Intermittent Stream - 1) A stream that flows only at certain times of the year, as when it receives water from springs or from a surface source; and 2) a stream that does not flow continuously, as when water losses from evaporation or seepage exceed the available stream flow.

Irretrievable - Applies to the loss of production, harvest, or use of natural resources. For example, some or all of the timber production from an area is lost irretrievably while an area is serving as a winter sports site. The production lost is irretrievable, but the action is not irreversible. If the use changes, it is possible to resume timber production.

Irreversible - Applies primarily to the use of nonrenewable resources, such as minerals or cultural resources, or to those factors that are renewable only over long time spans, such as soil productivity and aspen regeneration. Irreversible also includes loss of future options.

Jurisdictional Wetland - A wetland area identified and delineated by specific technical criteria, field indicators, and other information for purposes of public agency jurisdiction. The public agencies

which administer jurisdictional wetlands are the US Army Corps of Engineers, US Environmental Protection Agency, US Fish and Wildlife Service, and USDA-Soil Conservation Service.

Land Use - Land uses determined for a given area that establish the types of activities allowed (e.g., mining, agriculture, timber production, residences, industry) and the size of buildings and structures permitted.

Landform - Any physical, recognizable form or feature of the Earth's surface, having a characteristic shape and produced by natural causes. Includes major features such as plains, plateaus, and mountains, and minor features, such as hills, valleys, slopes, canyons, arroyos, and alluvial fans.

Landscape Character - The arrangement of a particular landscape as formed by the variety and intensity of the landscape features as defined as the four basic elements (form, line, color, and texture). These factors give the area a distinctive quality that distinguishes it from its immediate surroundings.

Lifts - Construction of waste rock dumps in a series of layers.

Lithology - The description of rocks in terms of the physical character of a rock, mineral composition, grain size, color and other physical characteristics.

Long-Term Effects - Long-term effects are effects that would remain following completion of the project. As an example, the loss of vegetation from the development of an open pit would be a long-term effect if the pit were not reclaimed and vegetation not re-established at the end of the project. Other long-term effects, as defined in the Cumulative Effects Analysis (CEA), are coarse and durable angle of repose waste rock dump slopes and haul roads.

Maximum Modification - A visual quality objective that allows activities that alter the vegetation and landform to dominate the original characteristic landscape with some limitations.

Mesic - Moist habitats associated with springs, seeps and riparian areas.

Milling - The general process of separating the economic constituents (metals) from the undesired or un-economic constituents of ore material (tailings).

Mineralization - The process by which a valuable mineral or minerals are introduced into a rock.

Mitigate, Mitigation - To cause to become less severe or harmful to reduce impacts. Actions to avoid, minimize, rectify, reduce or eliminate, and compensate for impacts to environmental resources.

Modification - A visual quality objective in which man's activity may dominate the characteristic landscape, but should appear as a natural occurrence when viewed as background.

Monitor - To systematically and repeatedly watch, observe or measure environmental conditions in order to track changes.

National Register of Historic Places - A list, maintained by the National Park Service, of areas which have been designated as being of historical significance.

Native Species - Plants that originated in the area in which they are found, i.e., they naturally occur in that area.

NEPA - The National Environmental Policy Act of 1969. It is the national charter for protection of the environment. NEPA establishes policy, sets goals, and provides means for carrying out the policy. Regulations at 40 CFR 1500-1508 implement the act.

Net Proceeds Tax - This is a form of income tax assessed as a property tax intended to assess the value of the minerals which are being extracted.

Noxious Weeds - An alien, introduced or exotic species that is adventive, aggressive, or overly-competitive with more desirable species.

Nutrients - Essential chemicals needed by plants or animals for growth and health. If other physical and chemical conditions are optimal, excessive amounts of nutrients can lead to degradation of water quality by promoting excessive growth, accumulation and subsequent decay of plants, especially algae. Some nutrients can be toxic to animals in high concentrations.

One-hundred year, twenty four-hour storm event (100-year, 24-hour) - the maximum precipitation predicted to occur within any 24-hour period over a period of 100 years.

Ordinary high water mark (OHWM) - line on the shore of a water body or stream established by the fluctuation of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas

Ore - A deposit of rock from which a valuable mineral or minerals can be economically extracted.

Overburden - Material which overlies a deposit of valuable material.

Pit Backfill - Placing waste rock in a mined-out pit.

Partial Retention - A visual quality objective in man's activities may be evident, but must remain subordinate to the characteristic landscape.

Patent - A document conveying title to land from the U. S. Government to private ownership.

Perched Water - Unconfined groundwater separated from the underlying main body of groundwater by unsaturated rock.

Perennial Stream - A stream or reach of a stream that flows throughout the year.

Permeable - The property or capacity of a porous rock, sediment, or soil to transmit a liquid.

pH - The negative $\log_{10}$ of the hydrogen ion activity in solution; a measure of acidity or basicity of a solution.

Phenologically - Relating to biological phenomena such as flowering, breeding, and migration, especially in conjunction with variation in climate.

Plan of Operations - As required by 43 CFR 3809, the operator submits a Plan of Operations (POO) to the BLM that includes: the name and address of the operator, location of the proposed area of operations, information sufficient to describe the type of operations proposed, and measures to be taken to meet the requirements for environmental protection.

Peak Flow - The greatest flow attained during melting of winter snowpack or during a large precipitation event.

Precious Metal - A general term for gold, silver or any of the minerals of the platinum group.

Preservation - A visual quality objective that provides for ecological change only.

Productivity - In reference to vegetation, productivity is the measure of live and dead accumulated plant materials.

Project Alternatives - Alternatives to the proposed Project developed through the NEPA process.

Protohistoric - Time period when native culture is in contact with outside culture before written record.

Public Scoping - Scoping is the process for determining the scope of issues and concerns to be addressed and for identifying the significant issues related to a proposed action. (40 CFR 1501.7).

Raptor - A bird of prey (e.g., eagles, hawks, falcons, and owls).

Recontouring - Restoration of the natural topographic contours by reclamation measures, particularly in reference to roads.

Record of Decision (ROD) - A decision document for an Environmental Impact Statement or Supplemental EIS that publicly and officially discloses the responsible official's decision regarding the actions proposed in the Environmental Impact Statement and their implementation.

Reserves - Identified resources of mineral-bearing rock from which the mineral can be extracted profitably with existing technology and under present economic conditions.

Resources (geologic) - Reserves plus all other mineral deposits that may eventually become available - either known deposits that are not recoverable at present, or unknown deposits, that may be inferred to exist but have not yet been discovered.

Retention - A visual quality objective which, generally means man's activities should not be evident to the casual forest visitor.

Riparian - Situated on or pertaining to the bank of a river, stream, or other body of water. Riparian is normally used to refer to plants of all types that grow along streams, rivers, or at spring and seep sites.

Runoff - That part of precipitation that appears in surface streams; Precipitation that is not retained on the site where it falls and is not absorbed by the soil.

Scoping - Procedures by which agencies determine the extent of analysis necessary for a proposed action, (i.e., the range of actions, alternatives, and impacts to be addressed; identification of significant issues related to a proposed action; and the depth of environmental analysis, data, and task assignments needed).

Sediment Load - The amount of sediment (sand, silt, and fine particles) carried by a stream or river.

Sediment - Material suspended in or settling to the bottom of a liquid. Sediment input comes from natural sources, such as soil erosion, rock weathering, agricultural practices, or construction activities.

Seismicity - The likelihood of an area being subject to earthquakes; the phenomenon of earth movements.

Short-Term Effects - Short term effects are defined under the Independence Range Cumulative Effects Analysis (CEA) process as those effects that would not last longer than the life of the project. As an example, the loss of vegetation from the construction of a drill road would be a short-term effect because the road would be reclaimed and vegetation re-established following completion of the project. Other short-term effects, as defined in the CEA, are revegetated areas such as waste rock dump slopes, facility areas and pit backfills.

Significant - As used in NEPA determination of significance requires consideration of both context and intensity. Context means that the significance of an action must be analyzed in several contexts such as society as a whole, and the affected region, interests, and locality. Intensity refers to the severity of impacts (40 CFR 1508.27).

Soil - Loose, unconsolidated surface material including the A and E horizon (topsoil) and B horizon (subsoil).

Sub-grade - Ore from which minerals cannot be extracted profitably with existing technology and under present economic conditions.

Threatened Species - Any species of plant or animal which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Total Dissolved Solids (TDS) - Total amount of dissolved material, organic or inorganic, contained in a sample of water.

Total Suspended Particulates (TSP) - Particulates less than 100 microns in diameter suspended in a liquid sample.

Total Suspended Solids (TSS) - Amount of undissolved particles suspended in liquid.

Visual Quality Objective (VQO) - A desired level of excellence based on physical and sociological characteristics of an area. Refers to degree of acceptable alteration of the characteristic landscape.

Visual Resource - The composite of basic terrain, geologic features, water features, vegetation patterns, and land use effects that typify a land unit and influence the visual appeal the unit may have for viewers.

Waste Dump - Location and/or destination of waste, spoil, or overburden material removed during the mining operation to expose the orebody, but not including the marketable mineral, subsoil and topsoil.

Waste Rock - Non-ore rock that is extracted to gain access to ore. It contains no ore metals or ore metals at levels below the economic cutoff value, and must be removed to recover the ore.

Waters of the United States - A jurisdictional term from Section 404 of the Clean Water Act referring to waterbodies such as lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation, or destruction of which could affect interstate or foreign commerce.

Watershed - The geographic region from which water drains into a particular stream, river or body of water. A watershed includes hills, lowlands, and the body of water into which the land drains. Watershed boundaries are defined by the ridges or divides separating watersheds.

Wetlands - Areas that are inundated by surface or groundwater with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction.

Wilderness - Land designated by Congress as a component of the National Wilderness Preservation System.

LIST OF ABBREVIATIONS

AMSL .... Above Mean Sea Level
AUM .... Animal Unit Months
BLM .... United States Department of the Interior Bureau of Land Management
°C .... Degrees Centigrade
CFR .... Code of Federal Regulation
cfs .... Cubic Feet Per Second
Corps .... United States Army Corps of Engineers
DEIS .... Draft Environmental Impact Statement
EIS .... Environmental Impact Statement
°F .... Degrees Fahrenheit
EPA .... United States Environmental Protection Agency
FEIS .... Final Environmental Impact Statement
FEMA .... Federal Emergency Management Agency
FT .... Feet or Foot
gpm .... Gallons Per Minute
MDBM .... Mount Diablo Meridian
mg/L .... Milligrams per Liter
NAC .... Nevada Administrative Code
NDEP .... Nevada Division of Environmental Protection
NDOM .... Nevada Division of Minerals
NDOT .... Nevada Department of Transportation
NDOW .... Nevada Division of Wildlife
NEPA .... National Environmental Policy Act
NPDES .... National Pollutant Discharge Elimination System
NRHP .... National Register of Historic Places
PM_{10} .... Particulate Matter less than ten microns
QA/QC .... Quality Assurance/Quality Control
ROD .... Record of Decision
SOAPA .... South Operations Area Project Amendment
SHPO .... State Historic Preservation Office
SPCCP .... Spill Prevention Control and Countermeasure Plan
TCP .... Traditional Cultural Properties
TDS .... Total Dissolved Solids
TECS .... Threatened, Endangered, Candidate and Sensitive
tpd .... Tons per Day
TSP .... Total Suspended Particulate
TSS .... Total Suspended Solids
µg/L .... Microgram per Liter
USFWS .... United States Fish and Wildlife Service
USGS .... United States Geological Survey
WAD .... Weak Acid Dissociable
WRDF .... Waste Rock Disposal Facility

INDEX

APPENDIX A
1999 PROGRESS REPORT FOR THE SOAP MITIGATION PLAN IMPLEMENTATION

RIPARIAN MONITORING ANALYSIS
SOAP MITIGATION PLAN
MAGGIE CREEK WATERSHED RESTORATION PROJECT

STREAM RESTORATION PHOTOGRAPHS

1999 Progress Report for the SOAP Mitigation Plan Implementation

DATE: February 2, 2000

MEMO TO: SOAP Interdisciplinary Team Members
FROM: Janice Stadelman
SUDJECT: 1999 Progress Report for the SOAP Mitigation Plan Implementation

ACTIVITY	TARGETED COMPLETION DATE	STATUS	REMARKS
Reclamation Test Plot Program	April 1994	Completed 1995 - ongoing due to results/changing technology	
Mitigation Surety	April 1994	Completed	
Conservation Easement (Maggie Cr. Watershed Restoration Project-Middle Maggie Creek)	April 1994	**NOT COMPLETED** (in progress)	
Fencing - Livestock Grazing Pastures	11/18/94	Completed (1994-1996) construction of following fences (*): * Chicken Springs * Drift * Northern Native * Lower Simon Creek * Boulder Valley Wetlands * Rainbow - Haskell Bench (see "Remarks" note)	-Haskell Bench Fence will be constructed only if a problem occurs with the grazing pastures in the future.
Water Gaps - #1-3 along middle Maggie Cr. & 1 above narrows and associated wells #1-3 along middle Maggie Cr.	11/18/94	Completed 1995-1996 (Summary of action: - fencing completed in 1995 - wells #1 & 3 drilled in 1995; #2 drilled in 1996; water systems installed in 1996)	Wells & water systems all installed on private lands.
Upper Simon Cr. Fence/Haul Road Wildlife Laydown Fence	11/18/94	Completed 1995	

ACTIVITY	TARGETED COMPLETION DATE	STATUS	REMARKS
North-South Haul Road Livestock Water Systems	1994	Completed 1994-1995 (Summary of action: wells drilled in 1994; installation of water systems completed in 1994-1995)	
Susie Creek Fence (8 miles)	11/18/94	**NOT COMPLETED** Newmont constructed approximately 2 miles of fence;no change in grazing management.	
SOAP Mitigation Plan - Newmont/BLM role on Maggie Creek Ranch controlled lands		**unresolved**	
Sand Dune Spring Riparian Study Preserve - Fencing	9/30/94 (Summary of action: fencing completed in 1994)	Completed 1994	One large area fenced around springs due to saturation of ground and accessability. This is the Boulder Valley Wetlands Fence.
Carlin Wetlands Area (110 acres)	(Summary of action: construction completed in 1994; seeded in 1995)	Completed 1994-1995	Cultural report for area BLM 1-1825(P); 2 eligible cultural sites CrNV-12-11783 & CrNV-12-11784
Livestock Grazing System(s); pastures involved are listed below -Lower Northern Native Pasture -Upper Northern Native Pasture -Chicken Springs -Haskell Bench -Horse Pasture -Drift Pasture -Simon Cr. -Jack Cr. -Little Jack Cr. -Coyote Cr. -N. Native Pasture	annually	Completed - ongoing	- Restoration areas were grazed in 1997, which was very successful.

ACTIVITY	TARGETED COMPLETION DATE	STATUS	REMARKS
Riparian Monitoring - selection Third Party Consultant	ongoing	Completed for 1994 and 1996 Pasture Evaluations/ Monitoring years. - Ongoing	
Riparian Monitoring Stations & Data Collection (1982.8 acres)	ongoing	Completed in 1994 and 1996. Continue to monitor and collect data.	
Riparian - Aerial Photographs	ongoing	Completed for 1994 and 1995. - Ongoing	Kept w/3809 File
Assessment of the Functional Condition of each Pasture/ Riparian Zone	ongoing	Completed for 1994 (baseline) and 1996. Continue to monitor.	
Planting - 100 saplings (Middle Maggie Creek)	Summary of Action: - planted 600-700 cottonwood seedlings	Completed	
Improvement of stream/ riparian habitat conditions on Lower Maggie Creek		Ongoing - reduction in scope	Elko Land & Livestock now grazes pastures H1-H7 that are below the narrows
Sand Dune Spring Irrigation Channel Water Diversion		Completed	Situation has undergone several changes due to Barrick's de-H_2O program
Lower Maggie Creek Stream Channel Stabilization Measures & Water Cooling System	Fall 1994	Stream Channel Stabilization completed. Construction of Cooling System completed.	
Maggie Creek Flow Augmentation Water Distribution System - Design	December 1994	Completed	
Maggie Creek Instream Structures		Not Completed; BLM decided against installation of structures and advises dropping this item	

ACTIVITY	TARGETED COMPLETION DATE	STATUS	REMARKS
Water Discharge into Maggie Cr.	bi-weekly inspections	- Ongoing	NPDES Permit
Groundwater Monitoring Wells - MAG A, B, C, D - PAL 4, MYC 4 - p. 20, Table II-1	11/18/94	Completed installation of all wells. Monitoring is ongoing.	PAL-4 relocated near PAL-1 & 3A;
Seeps & Springs - 25 sites (14 acres)	ongoing	Completed w/noted exception. Sites were evaluated in 1994, except JC 4 & 5. - Springs all fenced in 1995. Developed & installed water systems in 1996. **-Spring sites JC 4&5 still need field visit evaluations**	Sites to be fenced: - Flat Spring - Cherry Spring - Mud Spring - James Creek - Soap Creek Sites to be fenced & developed: #32 & 37 along Marys Mountain, provide they have water; #16 not to be fenced.
Marys River Stock Watering Well #4		Completed	2 wells installed in 1993/1994 at cost $19,000.
Funding District Hydrologist - $30,000	Annually	Completed	
Protection of Goshawk Nest - Fencing	N/A	N/A	BLM determined fencing unnecessary at present; continue to monitor
Overhangs & Alcoves in Final Pit Highwalls		**NOT COMPLE TED**	under BLM consultation; can't be completed until pit in final stages/closure
Dunphy Hills Seeding Project Phase I	Winter 1993	Completed March 1993	Approximately 1297 acres seeded. Dunphy Hills Seeding Project was mitigation for the NewmontTailing Impoundment 2/5 EA.

ACTIVITY	TARGETED COMPLETION DATE	STATUS	REMARKS
Dunphy Hills Seeding Project - Phase 2	Fall 1995	Completed Winter 1995	Approximately 570 acres seeded, 90 acres public & 480 acres private land
Dunphy Hills Seeding Project - Phase 3	Fall 1996	Completed Winter 1996	Approximately 1300 acres of private land seeded.
Dunphy Hills Seeding Project - monitoring site establishment & data collection	ongoing	Continue to monitor public lands	
Sagebrush Seeder - donated to NDOW	Upon completion of seedings	Completed 1996; Elko Land & Livestock/ Newmont donated to NDOW	
Seeding - 800 acres transition range for mule deer habitat losses from open pits	Fall 1996; Bob's Flat EFR & Mule Deer Mitigation Project (JDR# 6014) GPS surveyed public land acreages: greenblock = 949 acres core block = 970 acres	Completed 1997 Approximately 1919 acres of public land seeded; approximately 2300 acres private land seeded. Also planted Wyoming big sagebrush and 4-wing saltbush tublings.	Projects mitigated by these seeding acreages are 800 acres SOAP EIS + 300 acres Bootstrap EIS + 211 acres Section 36 EA + 75 acres Lantern EA 1386 acres used; + 533 acres banked as credit (available acres) for future mule deer habitat mitigation
Lynn Creek Ponds - monitoring for bats	N/A	BLM recommends this item be dropped from the mitigation plan since the ponds washed out from spring run-off in 1993.	
MCBMP Report	quarterly	Ongoing	
Seeps & Springs Report	semi - annual	Ongoing; Newmont proposed change to "fall monitoring only"	
Hydrographs Reported	monthly	Ongoing	
Hydrogeologic Model Monitoring Report	annually	Ongoing	

ACTIVITY	TARGETED COMPLETION DATE	STATUS	REMARKS
Cultural Reports for Mitigated Sites -haul road	* Section 106 (public land) - Reports due no later than 1 year from completion field work (private land)	Completed: All 4 sites have been mitigated. BLM received & accepted both reports. Report numbers are BLM 1-1756(P) & BLM 1-1773(P)	
Maggie Creek Cultural Site Monitoring - CRNV-12-11723	periodically during water discharge	Ongoing	

Riparian Monitoring Analysis
SOAP Mitigation Plan
Maggie Creek Watershed Restoration Project

Riparian Monitoring Analysis
South Operations Area Project Mitigation Plan
Maggie Creek Watershed Restoration Project
3-18-1997

Prepared by Elko District, BLM

INTRODUCTION

As mitigation for their South Operations Area Project (SOAP), Newmont Gold Company in conjunction with the Elko District Bureau of Land Management (BLM) and Elko Land and Livestock Company, developed the Maggie Creek Watershed Restoration Project (MCWRP) to improve stream and riparian habitat conditions within the Maggie Creek subbasin. Provisions for implementing the project are included within the Mitigation Plan (Appendix A) for the Final SOAP Environmental Impact Statement (EIS) completed in 1993.

The SOAP Mitigation Plan provided for an initial period of rest from grazing for key stream and riparian habitats. Grazing will be re-initiated in some of these areas once conditions have improved to levels established in the Mitigation Plan.

PURPOSE

The purpose of this report is to evaluate improvement in stream and riparian habitat conditions within the MCWRP area occurring since the Mitigation Plan was implemented in 1993 and to determine whether riparian restoration zones can be grazed starting in 1997.

ANALYSIS FRAMEWORK

This analysis is based on stream surveys conducted in the Maggie Creek subbasin by BLM (and in some cases the Nevada Division of Wildlife) in 1980, 1986, 1977, 1989 and 1992 and by EIP Associates (EIP) in 1994 and JBR Environmental Consultants, Inc. (JBR) in 1996. Both the EIP and JBR surveys were contracted by Newmont.

The monitoring program established in the Mitigation Plan was set up to take advantage of comparative data collected by BLM in previous years. Although comparisons between the 1994 and 1996 data were made by JBR, this report also compares current conditions to conditions existing prior to implementation of the Mitigation Plan. It is important to recognize 1994 data represent almost two growing seasons of rest. With few exceptions,

older BLM data represent conditions associated with growing season-long grazing on an annual basis.

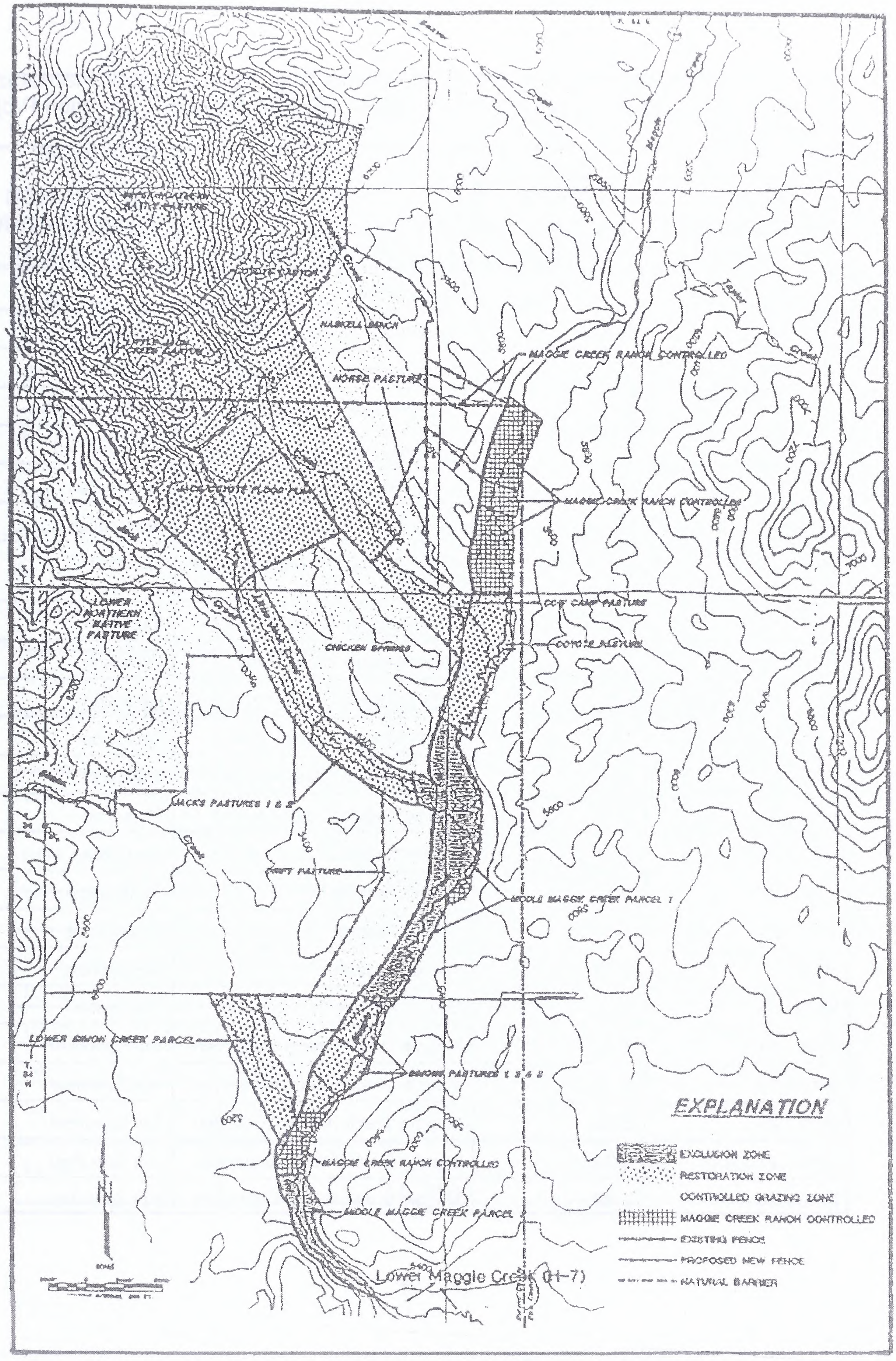
An attempt was made to compare data between years as much as possible, however, some of the information collected in 1994 and 1996 was not included in the earlier surveys. Also, some of the data collected in 1994 could not be used because of problems with measurement techniques or calculation methods. Nineteen ninety-four was also one of the driest years on record and actual stream measurements could not be taken in many locations.

Station data are averaged by pasture or grazing treatment area and compared between years where data are available. SOAP monitoring stations, their corresponding BLM monitoring stations, and planned grazing strategies as outlined in the Mitigation Plan are shown by pasture in Table 1. Pasture names and locations are shown in Figure 1.

Grazing strategies identified in the Mitigation Plan include restoration, exclusion, and controlled grazing. The restoration grazing strategy means that grazing will be excluded from these areas until certain biological standards for stream and riparian habitat conditions have been achieved. Exclusion means the area is permanently closed to grazing. Although pastures will controlled grazing designations as shown in Figure 1 are not included in the riparian monitoring program, these areas do have utilization restrictions and are required to be rested from grazing every third year. Grazing strategies are not specified for lands owned by Maggie Creek Ranch, however, the Mitigation Plan includes a general commitment to achieving or maintaining good habitat conditions in these areas as a cooperative effort.

The biological standards developed for restoration areas are shown in Table 2. Standards for streambank cover and stability (riparian condition class), stream width/depth ratio and width of the riparian zone were developed for stream systems, while standards for wetland (hydrophytic) plant cover were developed for nonstream habitats such as wet meadows where the stream channel is poorly defined.

Grazing history is important to the analysis of monitoring data. Prior to implementation of the Mitigation Plan, grazing within much of the MCWRP area was growing season-long. Since 1993, significant portions of Maggie, Coyote and Little Jack Creeks have been rested from livestock, although some pastures have been grazed recently as a result of trespass cattle from Maggie Creek Ranch, gates being left opened, fence construction schedules or planned grazing on the part of Elko Land and Livestock. Grazing use is summarized in Table 3 (pastures were rested in years not shown).



Lower Maggie Creek (H-7)

Table 1. SOAP and BLM Monitoring Stations, Pasture Names and Mitigation Plan Grazing Strategies For Pastures Included In The Maggie Creek Watershed Restoration Project (MCWRP) Area.

SOAP[1] MONITORING STATION	BLM STREAM SURVEY STATION	PASTURE NAME	MITIGATION PLAN GRAZING STRATEGY
		Maggie Creek	
MAG 1-3	None	Lower Maggie Creek (H-7)	Restoration[2]
MAG 4-6	None	Middle Maggie Creek Parcel 2	Exclusion[3]
MAG - 7	None	Maggie Creek Ranch Controlled	Not Specified[4]
MAG - 8	S-3	Maggie Creek Ranch Controlled	Not Specified
MAG - 9	S-4	Simons Pastures 1-3	Restoration
MAG - 10	S-5	Simons Pastures 1-3	Restoration
MAG - 11	S-6	Water Gap/Middle Maggie Creek Parcel 1	Exclusion
MAG - 13	S-7	Middle Maggie Creek Parcel 1	Exclusion
MAG - 14	S-8	Middle Maggie Creek Parcel 1	Exclusion
MAG - 15	S-9	Middle Maggie Creek Parcel 1	Exclusion
MAG - 16	S-10	Middle Maggie Creek Parcel 1	Exclusion
MAG - 17	S-11	Middle Maggie Creek Parcel 1	Exclusion
MAG - 18	S-12	Middle Maggie Creek Parcel 1	Exclusion
MAG - 19	S-13	Middle Maggie Creek Parcel 1	Exclusion
MAG - 20	S-14	Coyote Pasture	Restoration
MAG - 21	S-15	Coyote Pasture	Restoration
None	S-16	Coyote Pasture	Restoration
MAG - 23	S-17	Coyote Pasture	Restoration
MAG - 24	S-18	Maggie Creek Ranch Controlled	Not Specified
MAG - 25	S-19	Maggie Creek Ranch Controlled	Not Specified
MAG - 26	S-20	Maggie Creek Ranch Controlled	Not Specified
MAG - 27	S-21	Maggie Creek Ranch Controlled	Not Specified
MAG - 28	S-22	Maggie Creek Ranch Controlled	Not Specified

SOAP[1] MONITORING STATION	BLM STREAM SURVEY STATION	PASTURE NAME	MITIGATION PLAN GRAZING STRATEGY
		Coyote Creek	
COY - 1	None	Cow Camp Pasture	Restoration
COW - 1	None	Cow Camp Pasture	Restoration
SPR - 2	None	Cow Camp Pasture	Restoration
COY - 3	None	Jack/Coyote Floodplain (Upper N. Native)	Restoration
COY - 4	None	Jack/Coyote Floodplain (Upper N. Native)	Restoration
COY - 5	S-1	Jack/Coyote Floodplain (Upper N. Native)	Restoration
COY - 6	S-2	Coyote Canyon (Upper N. Native)	Restoration
COY - 7	S-3	Coyote Canyon (Upper N. Native)	Restoration
COY - 8	S-4	Coyote Canyon (Upper N. Native)	Restoration
COY - 9	S-5	Coyote Canyon (Upper N. Native)	Restoration
COY - 10	S-6	Coyote Canyon (Upper N. Native)	Restoration
COY - 11	S-7	Coyote Canyon (Upper N. Native)	Restoration
		Little Jack Creek	
LJ - 1	None	Jacks Pasture 2	Restoration
LJ - 2	None	Jacks Pasture 2	Restoration
LJ - 3	S-1	Jacks Pasture 1	Restoration
LJ - 4	S-2	Jacks Pasture 1	Restoration
LJ - 5	S-3	Jacks/Coyote Floodplain (Upper N. Native)	Restoration
LJ - 6	S-4	Jacks/Coyote Floodplain (Upper N. Native)	Restoration

SOAP[1] MONITORING STATION	BLM STREAM SURVEY STATION	PASTURE NAME	MITIGATION PLAN GRAZING STRATEGY
LJ - 7	S-5	Jacks/Coyote Floodplain (Upper N. Native)	Restoration
LJ - 8	S-6	Jacks/Coyote Floodplain (Upper N. Native)	Restoration
LJ - 9	S-7	Jacks/Coyote Floodplain (Upper N. Native)	Restoration
LJ - 10	S-8	Jacks/Coyote Floodplain (Upper N. Native)	Restoration
LJ - 11	S-9	Jacks/Coyote Floodplain (Upper N. Native)	Restoration
		Simon Creek	
SIM - 1	None	Lower Simon Creek Parcel	Restoration
SIM - 2	None	Lower Simon Creek Parcel	Restoration

1 South Operations Area Project.
2 Livestock are to be exclued from these zones (pastures) until the biological standards for stream and riparian habitat conditions specified in the Mitigation Plan have been achieved.
3 Permanently closed to grazing.
4 Although grazing strategies for these lands are not specifically defined in the Mitigation Plan, the Plan does include a genreal commitment to improving these areas in conjunction with Maggie Creek Ranch.

Table 2. Biological standards for pastures with a restoration grazing strategy as defined in the South Operations Area Project (SOAP) Mitigation Plan.

PASTURE	STREAM CRITERIA			WETLAND PLANT COVER CRITERIA
	Riparian Condition Class (% optimum)[1]	Stream Width/Depth Ratio	Riparian Zone Width	
		Maggie Creek		
Lower Maggie Creek (H-7)	70	15:1 or 30%↓	30%↑	NA[2]
Maggie Creek Simons Pasture	70	15:1 or 30%↓	30%↑	NA
Maggie Creek Coyote Pasture	70	15:1 or 30%↓	30%↑	NA

PASTURE	STREAM CRITERIA			WETLAND PLANT COVER CRITERIA
	Riparian Condition Class (% optimum)[1]	Stream Width/Depth Ratio	Riparian Zone Width	
Coyote Creek				
Cow Camp Pasture	NA	NA	NA	10%↑
Coyote Floodplain (Upper N. Native)	NA	NA	NA	>10%↑ (graze in conjunction with Little Jack/Coyote Canyons <10%↑ (graze in conjunction with Chicken Springs Pasture)
Coyote Canyon (Upper N. Native)	60	15:1 or 30%↓	30%↑	NA
Little Jack Creek				
Jacks Pastures 1 and 2	NA	NA	NA	10%↑
Jacks Floodplain (Upper N. Native)	NA	NA	NA	>10%↑ (graze in conjunction with Little Jack/Coyote Canyons) <10%↑ (graze in conjunction with Chicken Springs Pasture)
Little Jack Creek Canyon (Upper N. Native)	60	15:1 or 30%↓	30%↑	NA
Simon Creek				
Lower Simon Creek Parcel	NA	NA	NA	10%↑

1 Optimum is considered totally stable streambanks with medium to heavy cover of trees or tall shrubs.
2 Not applicable.

Table 3. Grazing occurring since 1993 in monitored pastures within the Maggie Creek Watershed Restoration Project (MCWRP) area.

PASTURE	YEAR	GRAZING USE
	Maggie Creek	
Lower Maggie Creek	1993-1994	Summer
Middle Maggie Creek Parcels 1 and 2	1994-1996	Limited trespass from Maggie Creek Ranch
Water Gaps	1994-1996	Growing Season-long [1]
	Coyote Creek	
Cow Camp	1996	291 head from 6/21 - 8/1
	Little Jack Creek	
Jacks Pastures 1 and 2	1996	339 head from 6/17 to early-mid August
	Simon Creek	
Lower Simon Creek Parcel	1993/94	Summer
	1995	Rest
	1996	Approx. 200 hd from June-July

[1]Optimum is considered totally stable streambanks with medium to heavy cover of trees or tall shrubs.
[2]Not applicable.

RESULTS

RESTORATION GRAZING AREAS

Monitoring results for restoration areas are summarized in Table 4. Data on which these conclusions are based is presented and discussed in the following sections.

Table 4. Summary of monitoring results for restoration grazing areas based on biological standards established in the SOAP Mitigation Plan.

PASTURE	PERFORMANCE RELATIVE TO BIOLOGICAL STANDARDS
Maggie Creek	
Lower Maggie Creek (H-7)	Not Met
Simon Pastures 1-3	Not Met*
Coyote Pasture	Not Met

PASTURE	PERFORMANCE RELATIVE TO BIOLOGICAL STANDARDS
Coyote Creek	
Cow Camp	Met
Coyote Floodplain (Upper N. Native)	Met (graze in conjunction with Coyote/Little Jack Canyons)
Coyote Canyon (Upper N. Native)	Met
Little Jack Creek	
Jacks Pastures 1	Not Met*
Jacks Pastures 2	Met
Jacks Floodplain (Upper N. Native)	Met (graze in conjunction with Coyote/Little Jack Canyons)
Little Jack Creek Canyon (Upper N. Native)	Met
Simon Creek	
Lower Simon Creek Parcel	Not Met

* Although technically not all biological standards have been met, pastures may be suitable for suitable grazing in 1997 (see following discussion).

STREAM MONITORING

Lower Maggie Creek (H7)

Although improvement between 1994 and 1996 has been good, biological standards have not been met for the Lower Maggie Creek Pasture (Table 5). Unlike upstream reaches, this area has only been rested from grazing since the beginning of the 1995 growing season. The level of improvement observed is reasonable for one and a half growing seasons of rest (data were collected in July of 1996). No information on stream width to depth ratio was collected for this pasture in 1994. In addition, no BLM stream survey stations were established in this area in 1980.

Summer water supply for this stream reach appears to be the result of reservoir mounding (Congdon 1997). Although upstream locations in the vicinity of the narrows were dry in July of 1994 and 1996, water was present in all or part of this reach during both the EIP and JBR surveys. In 1996, water levels were highest at MAG-1 (station closest to the reservoir) and lowest at MAG-3 (station just below the narrows). It is possible the absence of natural summer flow regimes may influence stream recovery processes and ability of the area to eventually meet existing biological standards.

Recommendation: Continue to rest for at least next two growing seasons. Re-evaluate in the third year (1999) to determine if biological standards have been met or if they need to be revised.

Table 5. Comparison of habitat parameters between 1994 and 1996 for Lower Maggie Creek. [1]

PARAMETER	1994	1996	% CHANGE
Riparian Condition Class (% optimum)[2]	45	50	+11
Stream Width/Depth Ratio	na[3]	44.5	na
Total Riparian Zone Width (ft)	9.8	12.4	+27
Riparian Zone Width (ft) >75% Cover	5.5	6.9	+25
Riparian Zone Width (ft) 50-75% Cover	4.3	5.5	+28
Ave. Shorewater Depth (ft)	Mostly dry	<0.01	na
Ave. Bank Overhang (ft)	Mostly dry	0.0	na
Ave. Woody Vegetation Overhang (ft)	Mostly dry	0.0	na

[1] Based on averages for stations MAG-1 through MAG-3 where data are available.
[2] Optimum is considered totally stable streambanks with medium to heavy cover of trees or tall shrubs.
[3] Not available.

Simons Pastures 1-3 (Maggie Creek)

Improvement has been excellent for this portion of Maggie Creek (Table 6). Although riparian condition class has not quite reached the target level of 70% of optimum, the 1996 rating represents improvement of more than 140% over the 1980 and 1986 conditions. While information on stream width to depth ratio is unavailable for 1994, a comparison to 1980 and 1986 data show a decrease of more than 30%. Although increase in total width of the riparian zone was less than 30%, the portion of the riparian zone with cover in excess of 75% has increased has increased by 42% since 1994. At the same time, width of the riparian zone with cover between 50 and 75% showed a substantial decrease. As riparian habitat conditions improve, the riparian zone is expected to become increasingly dense although outward expansion is limited by hydrology. Width of the riparian zone with 50-75% cover should decline as width of the riparian zone with cover in excess of 755 cover increases. The recent development of quality pools as well as the substantial

increase in shorewater depth, also support an assessment of good habitat conditions. The only variable not showing improvement was bank overhang.

Recommendation: Initiate an acceptable grazing treatment in 1997. Acceptable grazing treatments include those which are designed to improve or maintain riparian habitats (see discussion under Conclusions). Monitor utilization in years the pasture is grazed. Re-evaluate biological standards in three years (1999).

Biological standards have been met for width to depth ratio and for riparian zone width. Although technically the riparian condition class has not achieved the target level of 70%, condition of the riparian zone has improved dramatically over conditions existing prior to changes in grazing management. Implementation of acceptable grazing practices should not affect the ability of the riparian condition class to reach the target level of 70% of optimum within a few years.

Table 6. Comparison of habitat parameters between 1980, 1986, 1994 and 1996 for the portion of Maggie Creek included within Simon Pastures 1-3. [1]

PARAMETER	1980	1986	1994	1996	% CHANGE FROM 1980/86
Riparian Condition Class (% Optimum)[2]	25.8	25.0	49.5	62.0	+140 to +148
Stream Width/Depth Ratio	40.6	82.2	na[3]	22.8	-44 to -72
Riparian Zone Width (ft) >75% Cover	na	na	22.4	31.8	+42 (from 1994)
Riparian Zone Width (ft) 50-75% Cover	na	na	4.4	0.9	-80 (from 1994)
Ave. Shorewater Depth (ft)	na	na	0.05	0.24	+380
Ave. Bank Overhang (ft)	na	na	0.4	0.0	Undefined Decrease
Ave. Woody Vegetation Overhand (ft)	na	na	0.0	0.0	0

[1] Based on station averages for MAG-9 and MAG-10 and for BLM S-4 and S-5 where data are available.
[2] Optimum is considered totally stable streambanks with medium to heavy cover of tall shrubs or trees.
[3] Not available.

Recommendation: Continue to rest for at least next two growing seasons. Re-evaluate in the third year (1999) to determine if biological standards have been met or if they need to be revised.

Table 5. Comparison of habitat parameters between 1994 and 1996 for Lower Maggie Creek. [1]

PARAMETER	1994	1996	% CHANGE
Riparian Condition Class (% optimum)[2]	45	50	+11
Stream Width/Depth Ratio	na[3]	44.5	na
Total Riparian Zone Width (ft)	9.8	12.4	+27
Riparian Zone Width (ft) >75% Cover	5.5	6.9	+25
Riparian Zone Width (ft) 50-75% Cover	4.3	5.5	+28
Ave. Shorewater Depth (ft)	Mostly dry	<0.01	na
Ave. Bank Overhang (ft)	Mostly dry	0.0	na
Ave. Woody Vegetation Overhang (ft)	Mostly dry	0.0	na

[1] Based on averages for stations MAG-1 through MAG-3 where data are available.
[2] Optimum is considered totally stable streambanks with medium to heavy cover of trees or tall shrubs.
[3] Not available.

Simons Pastures 1-3 (Maggie Creek)

Improvement has been excellent for this portion of Maggie Creek (Table 6). Although riparian condition class has not quite reached the target level of 70% of optimum, the 1996 rating represents improvement of more than 140% over the 1980 and 1986 conditions. While information on stream width to depth ratio is unavailable for 1994, a comparison to 1980 and 1986 data show a decrease of more than 30%. Although increase in total width of the riparian zone was less than 30%, the portion of the riparian zone with cover in excess of 75% has increased has increased by 42% since 1994. At the same time, width of the riparian zone with cover between 50 and 75% showed a substantial decrease. As riparian habitat conditions improve, the riparian zone is expected to become increasingly dense although outward expansion is limited by hydrology. Width of the riparian zone with 50-75% cover should decline as width of the riparian zone with cover in excess of 755 cover increases. The recent development of quality pools as well as the substantial

increase in shorewater depth, also support an assessment of good habitat conditions. The only variable not showing improvement was bank overhang.

Recommendation: Initiate an acceptable grazing treatment in 1997. Acceptable grazing treatments include those which are designed to improve or maintain riparian habitats (see discussion under Conclusions). Monitor utilization in years the pasture is grazed. Re-evaluate biological standards in three years (1999).

Biological standards have been met for width to depth ratio and for riparian zone width. Although technically the riparian condition class has not achieved the target level of 70%, condition of the riparian zone has improved dramatically over conditions existing prior to changes in grazing management. Implementation of acceptable grazing practices should not affect the ability of the riparian condition class to reach the target level of 70% of optimum within a few years.

Table 6. Comparison of habitat parameters between 1980, 1986, 1994 and 1996 for the portion of Maggie Creek included within Simon Pastures 1-3. [1]

PARAMETER	1980	1986	1994	1996	% CHANGE FROM 1980/86
Riparian Condition Class (% Optimum)[2]	25.8	25.0	49.5	62.0	+140 to +148
Stream Width/Depth Ratio	40.6	82.2	na[3]	22.8	-44 to -72
Riparian Zone Width (ft) >75% Cover	na	na	22.4	31.8	+42 (from 1994)
Riparian Zone Width (ft) 50-75% Cover	na	na	4.4	0.9	-80 (from 1994)
Ave. Shorewater Depth (ft)	na	na	0.05	0.24	+380
Ave. Bank Overhang (ft)	na	na	0.4	0.0	Undefined Decrease
Ave. Woody Vegetation Overhand (ft)	na	na	0.0	0.0	0

[1] Based on station averages for MAG-9 and MAG-10 and for BLM S-4 and S-5 where data are available.
[2] Optimum is considered totally stable streambanks with medium to heavy cover of tall shrubs or trees.
[3] Not available.

Coyote Pasture (Maggie Creek)

Although the riparian condition class rating of 63% of optimum is indicative of good riparian habitat conditions, biological standards have not been met for this reach of Maggie Creek (Table 7). Recent deposition of gravel bars, particularly at MAG-21, has led to a high width/depth ratio and a redline in the width of the riparian zone with cover in excess of 75%. More of the riparian zone now includes sparsely vegetated gravel bars than was the case in 1994. Results for other monitoring parameters are variable. Quality pools have both increased and decreased since earlier surveys, while shorewater depth decreased since 1994. However, the fairly significant amount of overhanging woody vegetation present in 1996 and well as the presence of undercut streambanks (bank overhang) are indicative of good or improving habitat conditions overall.

The level of bar development evident during the 1996 survey may be a stage of channel evolution resulting from upstream erosion and downstream recovery. Eroding, vertical streambanks are present upstream both within the Coyote Pasture and on private lands owned by Maggie Creek Ranch. As the riparian zone becomes increasingly dense (as is the case with Maggie Creek), the ability of high flows to transport sediment is reduced, and sand or gravel bars can form in low velocity areas. In essence, well vegetated stream reaches can act like dams or sediment sinks particularly if upstream sediment sources are high. Exposed areas should become colonized with vegetation and eventually form stable streambanks. Similar channel dynamics have been observed on other stream recovery projects in the Elko District.

Recommendation: Continue to rest for at least one more growing season. Re-evaluate in the second or third year (1998 or 1999) to determine if biological standards have been met.

Table 7. Comparison of habitat parameters between 1980, 1986, 1994 and 1996 for the portion of Maggie Creek included within the Coyote Pasture. [1]

PARAMETER	1980	1986	1994	1996	% CHANGE FROM 1980/86
Riparian Condition Class (% optimum)[2]	47	33.5	58	63	+34 to +88
Stream Width/Depth Ratio	20.0	31.9	Na	47[3]	+135 to +47
Riparian Zone Width (total ft)	na[4]	na	35.2	33.0	-6 (from 1994)
Riparian Zone Width (ft) > 75% cover	na	na	33.6	26.3	-22 (from 1994)

PARAMETER	1980	1986	1994	1996	% CHANGE FROM 1980/86
Riparian Zone Width (ft) 50-75% Cover	na	na	1.6	6.7	+319 (from 1994)
% Stream Width With Quality Pools	74.5	4.9	Na	21.3	-71 to +335
Ave. Shore Depth (ft)	na	na	0.28	0.0	Undefined Decrease (from 1994)
Ave. Shore Overhang (ft)	na	na	0	0.04	Undefined Increase (from 1994)
Ave. Woody Vegetation Overhang (ft)	na	na	na	0.21	na

1 Based on station averages for MAG-20, MAG 21 and MAG 23 and BLM S-14 through BLM S-17 where data are available.
2 Optimum is considered totally stable streambanks with medium to heavy cover of tall shrubs or trees.
3 Several individual transects had extremely high width to depth ratios resulting in a high overall average, however, a number of transects also had very low width to depth rations.
4 Not available.

Coyote Canyon (Coyote Creek, Upper Northern Native)

Riparian habitat conditions are excellent for Coyote Creek within the Coyote Canyon of the Upper Northern Native Pasture (Table 8). The riparian condition class has improved significantly since 1977/92 and is now nearly at optimal levels indicating streambanks are extremely stable and are densely covered with woody riparian vegetation. While the stream has become more narrow and deep since the earlier surveys, the width/depth ratio recorded for 1996 probably represents potential for this stream type. Further bank development and subsequent narrowing of the stream channel is naturally limited in this system by gradient and a lack of bank building sediments. The riparian zone has continued to expand since 1994, especially for the portion with cover in excess of 75%. The increase has significantly exceeded the standard of 30%. The high percentage of stream width comprised of quality pools is also an important indicator of good aquatic habitat conditions. Although nearly the same portion of the stream width was recorded as supporting quality pools in 1992, a review of this data suggest observer error may have resulted in an overestimation of pool quality at that time. Although information on shorewater depth, bank overhang and overhanging wood vegetation could not be compared between 1994 and 1996, the 1996 data support an assessment of improving habitat conditions.

Recommendation: Biological standards have been met. Initiate an acceptable grazing treatment in 1997 in the Upper Northern Native Pasture. Monitor utilization during the pasture is grazed. Re-evaluate biological standards in three years (1999).

Table 8. Comparison of habitat parameters between 1980, 1986, 1994 and 1996 for Coyote Creek Canyon. [1]

PARAMETER	1977	1992	1994	1996	% CHANGE FROM 1977/92
Riparian condition Class (% optimum)[2]	66	64	89	93	+41 to +45
Stream Width/Depth Ratio	28.7	27.6	na	24.6	-14 to -11
Riparian Zone Width (total ft)	na[3]	na	12.1	20.8	+72 (from 1994)
Riparian Zone Width (ft) >75% Cover	na	na	10.3	18.9	+83 (from 1994)
Riparian Zone Width (ft) 50–75% Cover	na	na	1.8	2.0	+11 (from 1994)
% Stream Width with Quality Pools	0	25	na	23.8	Undefined Increase to -5
Ave. Shorewater Depth (ft)	na	na	na[4]	0.06	
Ave. Bank Overhang (ft)	na	na	na[4]	0.04	na
Ave. Woody Vegetation Overhang (ft)	na	na	na[4]	0.08	na

[1] Based on station averages for COY-6 through COY-11 and BLM S-2 through S-7 where data are available.
[2] Optimum is considered totally stable streambanks with medium to heavy cover of tall shrubs or trees.
[3] Not available.
[4] Although information on these parameters was collected in 1994, it is not clear whether the data were estimated or measured and whether or not water was present in the channel at the time information was recorded.

Little Jack Creek Canyon (Little Jack Creek, Upper North Native)

As with Coyote Creek, riparian habitat conditions for the portion of Little Jack Creek within the canyon (Upper Northern Native Pasture) are excellent (Table 9). Although there has

been no change in riparian condition class between 1994 and 1996, conditions have improved substantially over earlier surveys. The rating for 1996 is well in excess of the 60% standard and represents a situation of stable streambanks densely vegetated with willows. As with Coyote Creek, a width to depth ratio in the low to mid twenties appears to represent potential for this stream type. As expected, the greatest increase in the riparian zone width is for the portion with occur in excess of 75%. The decline in the portion with cover between 50 and 75% should occur as plants continue to fill in open spaces. Results for percent of stream width in quality pools are variable. More quality pools were encountered in 1989 than any other year. Although comparative data are unavailable, measurements for shorewater depth, bank overhang and overhanging woody vegetation indicate good streambank development.

Recommendation: Biological standards have been met. Initiate an acceptable grazing treatment in 1997. Monitor utilization during years the pasture is grazed. Re-evaluate biological standards in three years (1999).

Table 9. Comparison of habitat parameters between 1977, 1989, 1994 and 1996 for Little Jack Creek Canyon. [1]

PARAMETER	1977	1989	1994	1996	% CHANGE FROM 1977/89
Riparian condition Class (% optimum)[2]	65	46	83	83	+28 to + 82
Stream Width/Depth Ratio	22.1	29.6	na	24.0	+9 to -19
Riparian Zone Width (total ft)	na[3]	na	6.0	9.8	+63 (from 1994)
Riparian Zone Width (ft) >75% Cover	na	na	4.7	9.1	+94 (from 1994)
Riparian Zone Width (ft) 50–75% Cover	na	na	1.3	0.7	-46 (from 1994)
Ave. Bank Overhang (ft)	na	na	na[4]	0.19	na
Ave. Woody Vegetation Overhang (ft)	na	na	na[4]	0.11	na

[1] Based on station averages for LJ-9 through LJ-12 and BLM S-7 through S-10 where data are available.
[2] Optimum is considered totally stable streambanks with medium to heavy cover of tall shrubs or trees.
[3] Not available.
[4] Although information on these parameters was collected in 1994, it is not clear whether the data were estimated or measured and whether or not water was present in the channel at the time information was recorded.

NONSTREAM RIPARIAN MONITORING

Biological standards for hydrophytic cover were met for all pastures with the exception of Jack Pasture 1 and the Lower Simon Creek Parcel (Table 10). Although average hydrophytic cover did increase on Jack Pasture 1 by 6%, increases in plant cover occurred only for plots located in dry gravel beds. Hydrophytic cover decreased for the one study

site located in more representative meadow habitat as a result of a cattle trail becoming established within the plot boundaries in 1996. The decrease in hydrophytic cover for the Lower Simon Parcel is the result of approximately two months of unplanned use occurring in June and July of 1996. Monitoring photos taken near the end of July in 1996 show significant areas of bare ground and fairly heavy utilization levels in the area represented by the study plots.

Although percent increases for hydrophytic cover were high for both the Coyote and Little Jack floodplains, it is important to recognize that these areas remain poorly vegetated gravel fields. Response potential continues to be limited by a lack of perennial streamflow.

Recommendation: For pastures where biological standards have been met, initiate an acceptable grazing treatment in 1997. Monitor utilization during years pastures are grazed. Re-evaluate biological standards in three years (1999).

Jack Pasture 1 could be grazed in 1997 depending on the results of a field inspection to evaluate habitat conditions and to determine if existing plot locations are representative. Lower Simon Parcel should be rested in 1997, but could be re-evaluated in July of 1998.

Table 10. Changes in hydrophytic cover between 1994 and 1996 for nonstream riparian habitats.

PASTURE	STATIONS	HYDROPHYTIC COVER (%) (Average of All Stations)		% CHANGE
		1994	1996	
Coyote Floodplain (Upper N. Native)	COY-3 to 5	0.5	1.3	+160
Cow Camp Pasture	COW-1, COY-1, and SPR-2	61.6	72.2	+17
Jack Pasture 2	LJ-1 and 2	81.1	92.0	+13
Jack Pasture 1	LJ-3 to 5	31.8	33.7	+6
Little Jack Floodplain (Upper N. Native)	LJ-6 to 8	8.0	20.3	+154
Lower Simon Creek Parcel	SIM-1 and 2	66.0	61.9	-6

AREAS EXCLUDED FROM GRAZING OR CONTROLLED BY MAGGIE CREEK RANCH

STREAM MONITORING

Middle Maggie Creek Parcel 2

This portion of Maggie Creek has shown excellent improvement over the past two years (Table 11) although dewatering has affected two of three monitoring stations (Congdon 1997). The riparian condition class is at nearly 70% of optimum (target value for restoration grazing zones on Maggie Creek), while there has been more than a 30% increase in that portion of the riparian zone supporting more than 75% woody and herbaceous plant cover. Although no comparative data exists for the width to depth ratio, a ratio of 27:1 indicates the stream is becoming narrow and deep (at least at MAG-6 where water is present throughout the summer). Increases in the remaining parameters also support an assessment of good stream conditions. No BLM stream survey stations were established for this pasture in 1980.

As with the Lower Maggie Creek Pasture, it is possible the absence of natural summer flow regimes may influence stream recovery processes and ability of the area to maintain current habitat conditions.

Recommendation: This area is defined as an exclusion zone; no grazing is permitted. Re-evaluate in five years (2001) as per SOAP Mitigation Plan requirements.

Table 11. Comparison of habitat parameters between 1994 and 1996 for Middle Maggie Creek Parcel 2. [1]

PARAMETER	1994	1996	% CHANGE
Riparian Condition Class (% optimum)[2]	63	69	+10
Stream Width/Depth Ratio	na[3]	27	na
Total Riparian Zone Width (ft)	17	20	+18
Riparian Zone Width (ft) >75% Cover	12.1	16.0	+32
Riparian Zone Width (ft) 50-75% Cover	4.9	3.9	+20
Ave. Shorewater Depth (ft)	0.15	0.15	0
Ave. Bank Overhang (ft)	0.05	0.09	+80
Ave. Woody Vegetation Overhang (ft)	0.10	0.30	+200

[1] Based on averages for MAG-4 through MAG-6 where data are available.
[2] Optimum is considered totally stable streambanks with medium to heavy cover of trees or tall shrubs.
[3] Not available.

Maggie Creek Ranch Controlled (Above Narrows)

Different comparisons were made for station data depending on availability of information. Since MAG-8 had a corresponding BLM station (S-3), comparisons could be made between 1996, 1994, 1986 and 1980. Information which was collected in 1994 and 1996 but not in 1980 or 1986 is presented primarily for MAG-7 (much of the 1994 data for MAG-8 is missing).

Riparian habitat conditions are excellent for this portion of Maggie Creek and have improved substantially since the 1980's (Table 12). A rating of 76% of optimum for riparian condition class indicates streambanks are stable and well vegetated. Although the stream width to depth ratio appears to have increased, the 1996 data are biased upward by the presence of a blown-out beaver dam. No quality pools were encountered at transect locations on any of the surveys.

A comparison of data between 1994 and 1996 shows improvement in most parameters (Table 13). Riparian condition class is considered good to excellent, while shorewater depth, overhanging woody vegetation and bank overhang have all increased. Although the total width of the riparian zone appears to have remained static (the slight decrease is probably the result of observer differences), the portion of the riparian zone with cover in excess of 75% has increased by 14%. As described earlier, the decline in riparian zone width with cover between 50 and 75% should occur as plants colonize open spaces.

It should be noted that a major headcut progressing upstream through this reach may cause significant changes in habitat parameters in the future, particularly at MAG-8.

Recommendation: This section of stream is owned by Maggie Creek Ranch and does not have monitoring requirements in the SOAP Mitigation Plan. However, future monitoring of this reach in cooperation with Maggie Creek Ranch is useful to the understanding of stream dynamics for the entire Maggie Creek system.

Table 12. Comparison of habitat parameters between 1980, 1986, 1994 and 1996 for the portion of Maggie Creek controlled by Maggie Creek Ranch above the narrows. [1]

PARAMETER	1980	1986	1994	1996	% CHANGE FROM 1980/86
Riparian Condition Class (%optimum)[2]	45.5	30.5	76	76	+67 to +149
Stream Width/Depth Ratio	35.9	43.2	na[3]	60.8[4]	+69 to +41
% Stream Width With Quality Pools	0	0	0	0	0

[1] Based on data for MAG-8 and BLM S-3.
[2] Optimum is considered to totally stable streambanks with medium to heavy cover of tall shrubs or trees.
[3] Not available.
[4] Blown out beaver dam.

Table 13. Comparison of habitat parameters between 1994 and 1996 for the portion of Maggie Creek controlled by Maggie Creek Ranch above the narrows. [1]

PARAMETER	1994	1996	% CHANGE
Riparian Condition Class (%optimum)[2]	68.5	70.5	+3
Total Riparian Zone Width (ft)	21.0	20.3	-3
Riparian Zone Width (ft) >75% Cover	16.6	18.9	+14
Riparian Zone Width (ft) 50-75% Cover	4.4	1.4	-68%
Ave. Shorewater Depth (ft)	0.12	0.14	+17
Ave. Bank Overhang (ft)	0.04	0.08	+100
Ave. Woody Vegetation Overhang (ft)	0.0	0.10	Undefined increase

[1] Based on data from MAG-7 for all parameters except Riparian Condition Class. Riparian condition class is based on the average of MAG-7 and MAG-8.
[2] Optimum is considered totally stable streambanks with medium to heavy cover of tall shrubs or trees.

Middle Maggie Creek Parcel 1 - Water Gap

Habitat conditions have improved slightly in the portion of Maggie Creek serving as a water gap for Maggie Creek Ranch cattle (Table 14). However, the low values for riparian condition class and riparian zone width, as well as the increase in the width to depth ratio and lack of quality pools all indicate overall conditions remain poor. However, improvement was apparent for shorewater depth.

Recommendation: Re-evaluate conditions in five years in conjunction with Middle Maggie Creek Parcel 1 (2001) as per SOAP Mitigation Plan requirements.

Table 14. Comparison of habitat parameters between 1980, 1986, 1994 and 1996 for the portion of Maggie Creek included within Middle Maggie Creek Parcel 1 Water Gap. [1]

PARAMETER	1980	1986	1994	1996	% CHANGE FROM 1980/86
Riparian Condition Class (% optimum)[2]	25	na[3]	25	36	+44
Stream Width/Depth Ratio	30.9	na	na	54	+75
% Stream Width With Quality Pools	50	na	na	0	Undefined Decrease
Riparian Zone Width (total ft)	na	na	0	5.0	Undefined Increase
Riparian Zone Width (ft) 50-75% Cover	na	na	0	3.4	Undefined Increase (from 1994)
Ave. Shorewater Depth (ft)	na	na	0	0.27	Undefined Increase (from 1994)
Ave. Bank Overhang (ft)	na	na	0.4	0.0	Undefined Decrease (from 1994)
Ave. Woody Vegetation Overhang (ft)	na	na	0.0	0.0	0

[1] Based on station averages for MAG-11 and BLM S-6 where data are available.
[2] Optimum is considered totally stable streambanks with medium to heavy cover of tall shrubs or trees.
[3] Not available.

Middle Maggie Creek Parcel 1

As with other portions of Maggie Creek, improvement has been excellent (Table 15). With the exception of woody vegetation overhang, substantial improvement occurred for all variables over levels existing in 1980/86 and 1994. The decline in the portion of the riparian zone with 50-75% cover and increase in the portion with >75% cover represents filling in of open spaces. Currently, this reach of Maggie Creek is characterized by stable, well developed streambanks, quality pool habitat, a healthy riparian zone and a narrow, deep channel profile.

Recommendation: This area is defined as an exclusion zone; no grazing is permitted. Re-evaluate in five years (2001) as per SOAP Mitigation Plan requirements.

Table 15. Comparison of habitat parameters between 1980, 1986, 1994 and 1996 for the portion of Maggie Creek included within Middle Maggie Creek Parcel 1. [1]

PARAMETER	1980	1986	1994	1996	% CHANGE FROM 1980/86
Riparian Condition Class (% optimum)[2]	30.4	25	55.1	64.3	+112 to +157
Stream Width/Depth Ratio	33.8	48.5	na	26.6	-21 to -45
Riparian Zone Width (total ft)	na	na	30.7	41.8	+36 (from 1994)
Riparian Zone Width (ft) >75% Cover	na[3]	na	26.6	37.9	+43 (from 1994)
Riparian Zone Width (ft) 50-75% Cover	na	na	4.1	3.9	-5 (from 1994)
% Stream Width With Quality Pools	10.2	0	na	25.4	+149 to Undefined Increase
Ave. Shorewater Depth (ft)	na	na	0.06	0.14	+133 (from 1994)
Ave. Bank Overhang (ft)	na	na	0.03	0.09	+200 (from 1994)
Ave. Woody Vegetation Overhang (ft)	na	na	0.01	0.01	0 (from 1994)

[1] Based on station averages for MAG-13 through MAG-19 and BLM 5-7 through BLM S-13 where data are available.
[2] Optimum is considered totally stable streambanks with medium to heavy cover of tall shrubs or trees.
[3] Not available.

Maggie Creek Ranch Controlled-Upper Reach

Much of this reach is characterized by a dense, well developed riparian zone with deep pools, although vertical eroding banks persist in areas when channel downcutting has occurred in the past. Monitoring data show changes have occurred over time, but generally conditions remain good (Table 16). The riparian condition class is excellent and

has improved over earlier surveys, although changes in the width to depth ratio are variable. The recorded decline in width of the riparian zone for all three categories (total, 75% cover and 50-75% cover) is based on limited data (only data from stations MAG-24 and 25 were evaluated.) The high percentage of quality pools, depth at the shorewater interface, presence of undercut streambanks and overhanging woody vegetation are all indicative of good stream habitat conditions.

Recommendation: This section of stream is owned by Maggie Creek Ranch and does not have monitoring requirements in the SOAP Mitigation Plan. However, future monitoring of this reach in cooperation with Maggie Creek Ranch is useful to the understanding of stream dynamics for the entire Maggie Creek system.

Table 16. Comparison of habitat parameters between 1980, 1986, 1994 and 1996 for the portion of Maggie Creek controlled by the Maggie Creek Ranch. [1]

PARAMETER	1980	1986	1994	1996	% CHANGE FROM 1980/86
Riparian Condition Class (% optimum)[2]	60	42	58	79	+32 to +81
Stream Width/Depth Ratio	13.4	24.7	na[3]	18.7	+40 to -24
Riparian Zone Width (total ft)	na	na	53[4]	23[4]	-57 (from 1994)
Riparian Zone Width (ft) >75% Cover	na	na	53[4]	22[4]	-58 (from 1994)
Riparian Zone Width (ft) 50-75% Cover	na	na	0[4]	1[4]	Undefined Decrease (from 1994)
% Stream Width With Quality Pools	62	3	na	96	+55 to +3,100
Ave. Shorewater Depth (ft)	na	na	Dry	0.27	na
Ave. Bank Overhang (ft)	na	na	Dry	0.11	na
Ave. Woody Vegetation Overhang (ft)	na	na	Dry	2.71	na

[1] Based on station averages for MAG-24 through MAG-28 and BLM S-18 through S-22 where data are available.
[2] Optimum is considered totally stable streambanks with medium to heavy cover of tall shrubs or trees.
[3] Not available.
[4] Based on data from MAG-24 and MAG-25 only since no information was collected at MAG-26, 27 or 28 in 1994.

OTHER MONITORING

Functioning Condition Assessments

Where information was available, all stream and riparian areas within the MCWRP area were rated as being in proper functioning condition (PFC) or functional at risk upward trend by 1996 (Table 17). PFC means riparian-wetland areas are able to dissipate energy associated with high flows; filter sediment; capture and store runoff; support diverse habitat characteristics; and, have healthy well developed riparian zones. Functioning "at risk" means the system is functioning, but an existing soil, water, or vegetation attribute makes them susceptible to degradation.

Where stream segments or wetland areas were rated as being functional at risk-upward trend in 1996, usually only one of many attributes was considered not to be representative of properly functioning conditions. In essence, all areas evaluated were very close to being rated as PFC. Consequently, evaluated areas should be resistant to degradation with proper grazing management.

Recommendation: The Mitigation Plan requires that functioning condition assessments be completed in 1994, again before livestock are reintroduced to areas scheduled for grazing, and at five years after that time. As indicated in Table 17, not all the required assessments be completed in 1994, again before livestock are reintroduced to areas scheduled for grazing, and at five years after that time. As indicated in Table 17, not all the required assessments have been completed. Depending on whether grazing is permitted in 1997, lentic (standing water) assessments need to be completed for Cow Camp Pasture, Jacks Pasture 1 and 2, and Lower Simon Creek Parcel prior to turn-out of cattle. Although assessments were completed for Coyote Canyon (Upper Northern Native) and Coyote Pasture (Maggie Creek) as scheduled, the assessments were for lentic rather that lotic habitats. The lotic analysis is more appropriate for flowing water habitats, whereas the lentic assessment is more applicable to areas supporting standing water. Any future functioning condition assessments of these two areas should be based on the lotic checklist.

Table 17. Results of Functioning Condition Assessments for 1994 and 1995.

PARCEL	MITIGATION PLAN CHECKLIST REQUIREMENT	FUNCTIONING CONDITION ASSESSMENT (LOTIC)		FUNCTIONING CONDITION ASSESSMENT (LENTIC)	
		1994	1996	1994	1996
		Maggie Creek			
Lower Maggie Creek (H-7)	LOTIC	Nonfunctional	Functional at Risk-Upward Trend	NA[1]	NA

PARCEL	MITIGATION PLAN CHECKLIST REQUIREMENT	FUNCTIONING CONDITION ASSESSMENT (LOTIC)		FUNCTIONING CONDITION ASSESSMENT (LENTIC)	
		1994	1996	1994	1996
Middle Maggie Creek Parcel 2/Lower Maggie Creek Ranch Controlled	None	Functional at Risk-Upward Trend	Functional at Risk-Upward Trend	NA	NA
Simons Pastures 1-3 (Maggie Creek)	LOTIC	Functional at Risk-Upward Trend	Functional at Risk-Upward Trend	NA	NA
Middle Maggie Creek Parcel 1	None	Functional at Risk-Upward Trend	Functional at Risk-Upward Trend	NA	NA
Coyote Pasture (Maggie Creek)	LOTIC	Functional at Risk-Upward Trend	Not Completed	NA	Functional at Risk-Upward Trend[2]
Upper Maggie Creek Ranch Controlled	None	Functional at Risk-Upward Trend	NA	NA	NA
		Coyote Creek			
Cow Camp Pasture	LOTIC/ Revised to LENTIC (5-30-96)[3]	Not Completed	NA	NA	Not Completed
Jack/Coyote Floodplain (Upper N. Native)	LOTIC; Revised to None (5-30-96)	Not Completed	NA	NA	NA
Coyote Canyon (Upper N. Native)	LOTIC	Proper Functioning Condition (PFC) - Upward Trend	Not Completed	NA	Proper Functioning Condition (PFC) - Upward Trend[2]

PARCEL	MITIGATION PLAN CHECKLIST REQUIREMENT	FUNCTIONING CONDITION ASSESSMENT (LOTIC)		FUNCTIONING CONDITION ASSESSMENT (LENTIC)	
		1994	1996	1994	1996
Little Jack Creek					
Jacks Pastures 1 and 2	LOTIC; Revised to LENTIC (5-30-96)	Not Completed	NA	NA	Not Complet ed
Jacks/Coyote Floodplain (Upper N. Native)	LOTIC; Revised to None (5-30-96)	Not Completed	NA	NA	NA
Little Jack Creek Canyon (Upper N. Native)	LOTIC	Proper Functioning Condition (PFC)	Proper Functioning Condition (PFC)/Functional at Risk-Upward Trend	NA	NA
Simon Creek					
Lower Simon Creek Parcel	LOTIC; Revised to LENTIC (5-30-96)	Not Completed	NA	NA	Not Complet ed

[1] Not applicable.
[2] Based on Lentic Functioning Condition Assessment which is more suited to standing water riparian habitats including seeps, springs and meadows.
[3] Based on recommendations presented in a letter from BLM to Martin Jones dated 5-30-96.

Pebble Count

Pebble count data were collected for the first time in 1996 for all monitored stream reaches. Although no comparative data are available, the 1996 data will provide a baseline for future monitoring.

CONCLUSIONS

Stream and riparian habitats within the MCWRP area have improved significantly since implementation of the Mitigation Plan in 1993. Currently most aquatic-wetland habitats within the restoration area support healthy well developed riparian zones. Where biological standards have been met, implementation of acceptable grazing treatments should not result in degradation of stream or riparian habitat conditions. Acceptable grazing treatments are those which will result in maintenance of biological standards. Examples include cool season (especially spring) grazing, short duration grazing, providing for regrowth at least 75% of the time over the course of a four-year grazing cycle, application of utilization restrictions and use of tools such as prescribed burning, riding, and

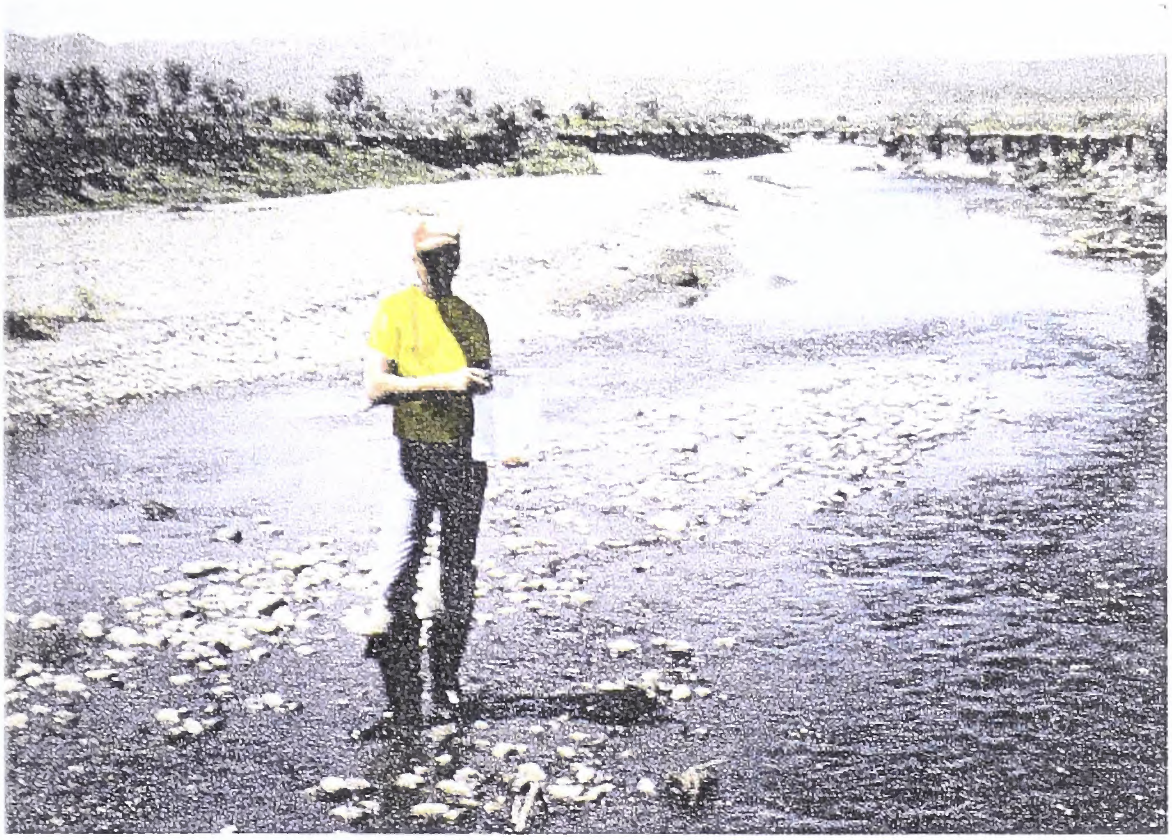
supplemental feeding to reduce use of riparian areas. Other treatments may be appropriate based on local experience or applicable literature.

The stream and riparian habitat monitoring program established for the MCWRP is working well, although there is a need to revise some of the biological standards as previously discussed by Newmont and BLM. The width to depth ratio requirement for Coyote and Little Jack Creeks of 15:1 or a 30% decline over baseline conditions should be changed in favor of maintaining a stream width to depth ratio in the low to mid twenties. Evaluation of riparian zone width data should be based on stratification by cover. As previously discussed, an improving riparian zone should become increasingly dense although outward expansion may be limited by hydrology.

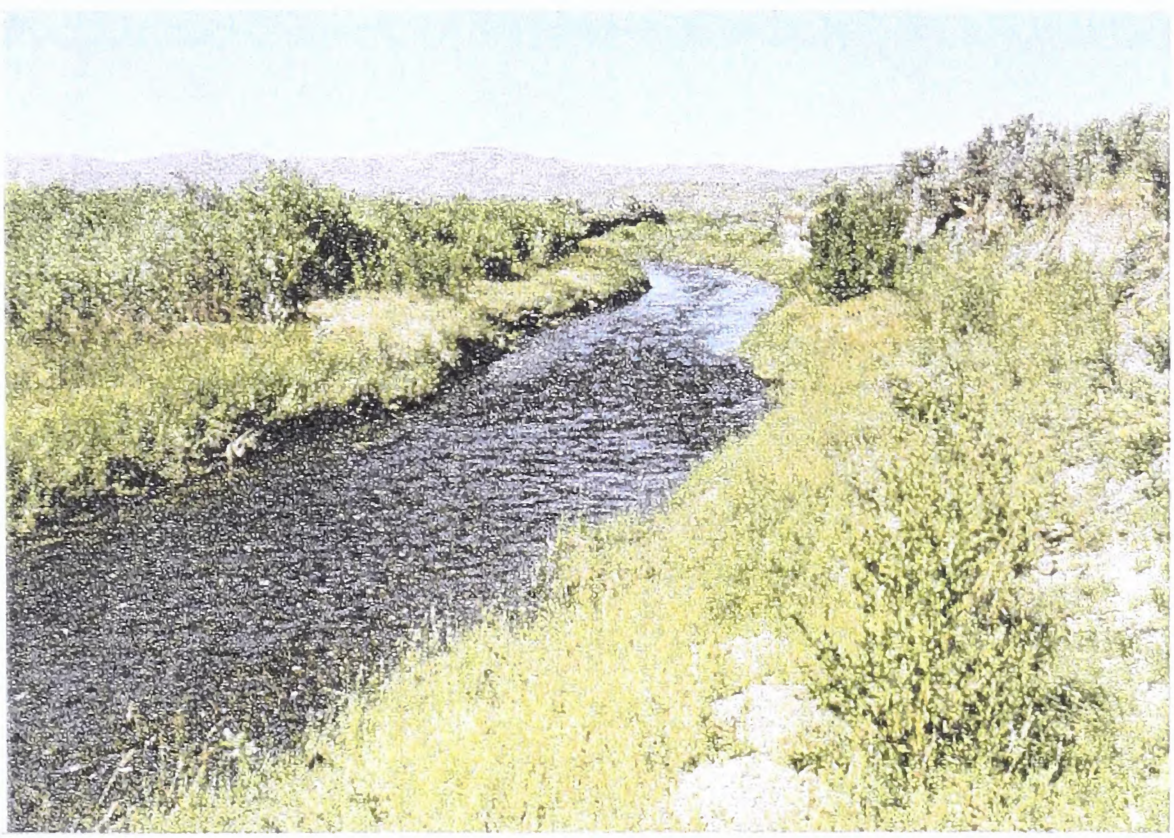
REFERENCES CITED

Congdon, Roger. 1997. Geologist. Personal communication. Elko Field Office, Bureau of Land Management, Elko, Nevada.

Stream Restoration Photographs



Maggie Creek. Station 4, Transect 1. 7-5-86. Degraded habitat conditions including a wide, shallow channel; excessive deposition of gravels and find sediments; lack of riparian vegetation; and, absence of a funtional floodplain characterized much of Maggie prior to implementation of the South Operation Area Project (SOAP) plan.



Maggie Creek. Station 4, Transect 1. 7-1-99. Stream and riparian habitat conditions have improved dramatically since the SOAP Mitigation Plan was implemented in 1993. Although this area is still grazed by livestock, changes in the timing and duration of grazing have resulted in developlment of a much a much narrower, deeper stream channel as well as stable, vegetated streambanks. Most importantly, Maggie Creek now has a functional, hydrated floodplain and a healthy riparian zone.

Coyote Creek. Station 2, Transect 2. 8-18-77. Prior to the implementation of the South Operations Area Project (SOAP) Mitigation Plan, habitat conditions along Coyote Creek were extremely poor as shown by a shallow, exposed channel and nearly complete absence of streambank vegetation. Under these conditions trout are susceptible to excessive summer water temperatures as well as lethal icing conditions in winter.

Coyote Creek. Station 2, Transect 2. 9-20-99. Changes in grazing management initiated through the SOAP Mitigation Plan have allowed for the vigorous growth and establishment of a healthy willow riparian zone. As shown in the insert, Coyote Creek is now characterized by stable, well vegetated streambanks and a much narrower and deeper stream channel. The result is greatly improved habitat conditions for the threatened Lahontan cutthroat trout.

APPENDIX B
VISUAL CONTRAST RATING WORKSHEETS

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date 17 October 1997

District Elko

Resource Area Elko

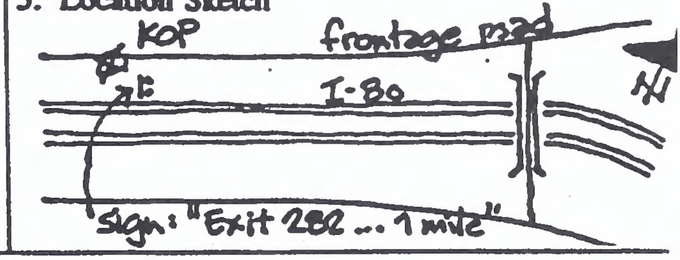
Activity (program) mining

SECTION A. PROJECT INFORMATION

1. Project Name Newmont SOAPA
2. Key Observation Point #1 I-80 1mi E of E. Carlin Interchg
3. VRM Class II

4. Location
Township 33N
Range 53E
Section 19

5. Location Sketch



SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	flat to rolling w/angular forms @ mine, hwy + R.R.	simple-indistinct	angular - horizontal
LINE	horizontal-weak diagonal diagonal stronger in afternoon	weak	broken-irregular-indistinct
COLOR	chalky buff + reddish tan	brown-tan foreground gray/tan/buff/yellowish	black, dark gray, yellows, white, brown + tan
TEXTURE	smooth - uniform	fine - subtle/uniform - random	random - clumped

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	flat - angular	same as above	angular - horizontal
LINE	horizontal		broken-irregular-indistinct
COLOR	light gray, tan, brown		yellow-white-brown-tan
TEXTURE	smooth - uniform		random - clumped

SECTION D. CONTRAST RATING ☐ SHORT TERM ☒ LONG TERM

1. DEGREE OF CONTRAST

ELEMENTS	Land/Water Body (1) Strong	Moderate	Weak	None	Vegetation (2) Strong	Moderate	Weak	None	Structures (3) Strong	Moderate	Weak	None
Form			X					X			X	
Line				X				X			X	
Color			X				X				X	
Texture				X				X			X	

2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)

3. Additional mitigating measures recommended ☐ Yes ☒ No (Explain on reverse side)

Evaluator's Names: Dehn Solomon

Date: 10-17-97

SECTION D. (Continued)

Comments from item D 2.

Changes consist of increased height and lateral extent of embankments and additional buildings.

Additional Mitigating Measures (See item 3)

U.S. GOVERNMENT PRINTING OFFICE: 1988—461-986/33094

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

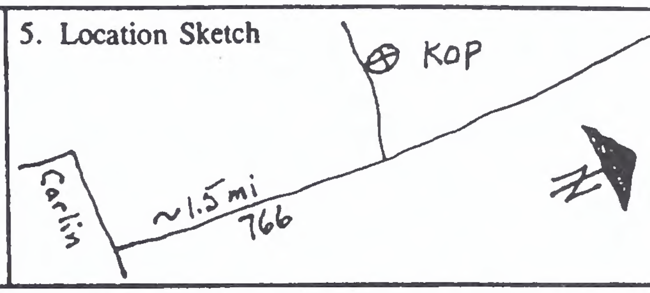
Date 17 October 1997
District Elko
Resource Area Elko
Activity (program) mining

SECTION A. PROJECT INFORMATION

1. Project Name
Newmont SOAPA
2. Key Observation Point
#4 Maggie Cr. Rd. / Carlin Landfill Rd.
3. VRM Class
II / IV

4. Location
Township 33N
Range 52E
Section 22

5. Location Sketch



SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	flat to rolling angular/geometric	indistinct	irregular - blocky
LINE	horizontal - angular	weak - undulating	weak
COLOR	chalky buff - gray pastel reds	brown - tan - buff	buff - white - gray
TEXTURE	fine - patchy - random	fine	discontinuous - random

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	flat to rolling angular/geometric	same as above	irregular - blocky
LINE	horizontal - angular		weak
COLOR	chalky buff - gray pastel reds		buff - white - gray
TEXTURE	fine - patchy - random		discontinuous - random

SECTION D. CONTRAST RATING ☐ SHORT TERM ☒ LONG TERM

1. DEGREE OF CONTRAST

	FEATURES											
	LAND/WATER BODY (1)				VEGETATION (2)				STRUCTURES (3)			
ELEMENTS	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None	Strong	Moderate	Weak	None
Form		X					X			X		
Line			X				X				X	
Color			X				X				X	
Texture			X				X				X	

2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)

3. Additional mitigating measures recommended ☐ Yes ☒ No (Explain on reverse side)

Evaluator's Names: Dehn Solomon
Date: 10-17-97

SECTION D. (Continued)

Comments from item 2.

Change to consist of increased lateral extent of leach pads and increased height of WRDFs at left and right margins of facility site. Change will attract attention but should not have significantly greater dominance than existing operations. Steam plumes from roaster and cooling towers have strong contrasts, but are intermittant.

Note: area is in Class II Highway corridor but separated from highway by ridge. Views from KOP are Class IV with Class III in background.

Additional Mitigating Measures (See item 3)

☆U.S. GOVERNMENT PRINTING OFFICE: 1988—461-986/33094

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

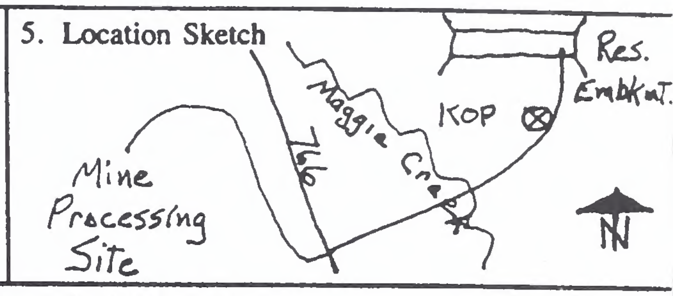
Date 17 October 1997
District Elko
Resource Area Elko
Activity (program) mining

SECTION A. PROJECT INFORMATION

1. Project Name: Newmont SOAPA
2. Key Observation Point: #6 Maggie Creek Ranch Reservoir access rd.
3. VRM Class: IV

4. Location
Township 34N
Range 52E
Section 32

5. Location Sketch



SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Flat to rolling w/angular geometric forms at mine	indistinct	angular - horizontal
LINE	horizontal, angular, diagonals at mine	weak	irregular, broken - plumes have strong contrast
COLOR	brown - tan - buff	brown - tan - buff	brown - gray - white plumes have strong contrast
TEXTURE	fine - patchy - random	fine	random - clumped

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	flat, rolling, angulat at mine	Same as above	irregular, angular, horizontal
LINE	horizontal, angular		irregular, indistinct
COLOR	brown, tan, buff		brown, gray, white
TEXTURE	fine, patchy, random		random, clumped

SECTION D. CONTRAST RATING ☐ SHORT TERM ☒ LONG TERM

1. DEGREE OF CONTRAST

ELEMENTS	Land/Water Body (1) Strong	Moderate	Weak	None	Vegetation (2) Strong	Moderate	Weak	None	Structures (3) Strong	Moderate	Weak	None
Form		X					X			X		
Line				X			X				X	
Color				X			X			X		
Texture				X			X				X	

2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)

3. Additional mitigating measures recommended ☐ Yes ☒ No (Explain on reverse side)

Evaluator's Names: Dehn Solomon
Date: 10-17-97

SECTION D. (Continued)

Comments from item 2.

Change to consist of increased lateral extent of leach pads to the south; increased height of WRDF to the west of KOP. Changes will not have significantly greater dominance than existing forms.

Additional Mitigating Measures (See item 3)

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Bureau of Land Management
Elko Field Office
3900 East Idaho Street
Elko, Nevada 89801